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Cables for Rural Transmission

EXTENSIONS into rural areas have come to be associated with the use of overhead lines, since the type of load and its scattered nature call for the adoption of a form of construction that generally has obvious advantages from the economic aspect. Moreover, in the open country a system in which insulation costs are low and heavy reinstatement charges can be avoided is both feasible and attractive.

Present practice has thus been dictated primarily by questions of first cost, and, apart from a few exceptional cases, overhead lines have been recognised as providing the best means of transmission in the circumstances.

Nevertheless, if the overall annual costs of placing the lines underground had been no more than those incurred by running bare conductors on poles, the use of the latter would have been normally confined to districts in which ground subsidence or abnormal topography was encountered. Although many points other than cheapness may be made in favour of overhead transmission, they are not enough to offset the advantages of having the conductors out of sight (and, it may be said, out of mind), the low maintenance costs and almost negligible reactance found with a cable system.

The much greater cost of underground work seemed to rule it out of consideration, but a suggestion that there might soon be grounds for modifying the accepted opinion was made by Mr. P. V. Hunter in his presidential address to the Institution of Electrical Engineers two and a half years ago. He then expressed the view that there were no good technical reasons against the adoption in the design of 11-kV cables of the high working stress permitted with 66-kV cables, and that the standardisation of one type of cable, having the same size of conductor, with a reduced thickness of dielectric would materially improve the case for underground transmission.

Since then Mr. Hunter has continued his investigations and, in collaboration with Mr. H. J. Allcock, gives our readers, on a later page, the technical particulars of the new unarmoured rural cable that has been designed to meet the specific purpose.

The authors also answer a question that was raised as a result of Mr. Hunter's original proposals as to the effect of capacity currents with large 11-kV cable networks. These are shown to be relatively unimportant, having regard to load conditions normally encountered in rural areas, especially when associated with urban undertakings.

Savings in the cost of cables, however, do not take us all the way. Though the cost of trenchwork in fields is so much less than it is in towns, it nevertheless forms a large proportion of the total. To supplement the results of electrical research comes the cable-laying plough, due to Sir Bernard Greenwell, who describes in this issue the machine built by Mr. W. J. H. Wood and the staff of the County of London Electric Supply Co., who have put it into operation with conspicuous success.

The work recorded in the articles mentioned should appreciably widen the scope for cables in rural areas. It will, we believe, prove a fruitful subject for some of those unofficial discussions which will, no doubt, be as useful a feature of the forthcoming I.M.E.A. Convention as at its predecessors.

A Variety of Interests

IT has been abundantly proved that specialisation pays. And yet in the electrical industry the converse has been equally clearly demonstrated: several of our leading concerns have found salvation in versatility. An example of this is found in the business of Siemens Bros. & Co., Ltd. Formed in 1880, principally for the manufacture of submarine and power cables, the company has added to its activities the manufacture of telephone cable and apparatus, electric totalisators, marine radio and other equipment, traffic control systems, lamps and batteries. The old-established business in submarine cable with gutta-percha insulation has been transferred to a new company formed in conjunction with the

T.C. & M. Co. At the annual meeting Lord Queenborough, chairman of Siemens Bros., explained the reason for this step; the falling-off in the demand for this class of cable has rendered it impossible for the two companies to continue manufacturing it. All the other sections of the company's business have continued to progress, enabling the dividend to be raised to 6 per cent. Lord Queenborough held out hopes of a maintenance of this progress during the current year.

A Domestic Development

THE agreement between Siemens Bros. and the Automatic Electric Co., Ltd., by which the former marketed the latter's "Xcel" domestic electrical appliances was recently terminated and the Automatic Electric Co. formed Elexcel, Ltd., to manufacture and sell these appliances. Lord Queenborough, referring to this at the Siemens meeting, announced that a complete range of appliances, including cookers, water-storage tanks and other heaters, was to be marketed under the company's own trade name of "Siemens." The new appliances are to be introduced at the I M.E.A. Convention next month.

The Meters Bill

THE Electricity Supply (Meters) Bill has now passed through all its stages in both Houses of Parliament and awaits the Royal Assent. Not later than an "appointed day" to be fixed by the Minister of Transport a "sufficient number of competent and impartial persons" are to be appointed meter examiners by the Commissioners. All supply authorities are to render available suitable meter-testing equipment for the use of these examiners, who will take over the duties in relation to meters of the "electric inspectors" provided for in the 1899 Act. It was revealed in the course of a recent legal action by an electricity supply authority against a consumer that only a few authorities had appointed "electric inspectors," and that, consequently, most of the meters in use (although of patterns approved by the Electricity Commissioners) were uncertified and therefore were "illegal." It was to clear up this position that the Bill was introduced by Mr. H. G. Williams in the House of Commons and Lord Eltisley in the House of Lords. The existing meters will now be deemed to be legal until disconnected and removed, or until the expiration of ten years from the "appointed day," whichever is the earlier.

Collection of Accounts

ONCE again the question has arisen of whether the collection of electricity accounts of a municipal undertaking should be taken out of the hands of the Electricity Department. It is certain that, were such a step adopted generally, municipal sales of electrical appliances would be detrimentally affected. The cashier's counter placed judiciously in a showroom so that the consumer coming to pay his account sees an attractive array of electrical appliances is a favourite method of sales propaganda and, we believe, a very profitable one. It would be absurd, merely for the sake of financial red tape, to damage the business of a trading organisation, and we are glad to learn that in the town in question the present procedure whereby the Electricity Department undertakes the collection of accounts is likely to be continued.

The Shopkeeper's Dilemma

THE demand of the average shop is an awkward one for supply authorities. It is generally lighting only, and it comes on to the mains at an inconvenient time. That is not to say that it should be discouraged, for good shop lighting is an excellent advertisement for electricity and possibly a stepping-stone to greater and more extended use of electricity by the shopkeepers. The usual system of charge—a fixed amount based upon the wattage, plus a low running charge—does not tend to the extended use of electricity. A commercial customer needs a lot of convincing that an extra two or three kilowatts of lamps is worth while if his fixed charge makes a substantial leap upwards. Mr. F. R. Jervis considers this problem in an article on page 787 of this issue. He distinguishes between "customer costs" and "demand costs," and favours a scale of "blocked" demand charges by which the fixed payment per kW falls after a certain point in a series of steps. The idea is not a new one, but we believe that its more general adoption would be equitable to the consumer and still profitable to the undertaking.

High-Frequency Control

THE principle of employing electrical methods of performing electrical operations is to be commended. Yet the use of high-frequency currents, superimposed on supply networks, for the control of separate switches from a central point has not made as much headway as might have been expected. In some systems of remote control employed in Great Britain the neutrals of three-phase power systems transmit the high-frequency currents for operating the relays; this necessitates the insertion in the earth connection of the secondary winding of a high-frequency transference, which thus forms in effect an impedance at a point that is at first glance forbidden by Supply Regulation 4 (e). This is not the final word, however, as the Electricity Commissioners granted exemption for this specific purpose to seven undertakings in 1934-35, and there need be no hesitation in considering this method of remote control. Another system in use on the Continent, which does not use the neutral, is described in this issue.

Reconstructing Switchgear

CONFIRMATION of the view that heavy expenditure is not necessarily incurred in increasing the rupturing capacity of switchgear to meet conditions created by growth of load is provided by the work of reconstruction completed yesterday at Wolverhampton. In an article published by us on October 7th, 1932, we gave a forecast of this scheme, which involved the building of a new switch-house at Commercial Road power-station to accommodate 6.6-kV metal-clad panels rated at 500,000 kVA to replace thirty-seven older units. The scheme also included alterations to the 6.6-kV switchgear in 160 sub-stations. Only a dozen entirely new circuit-breakers were required, as the existing panels have been moved from one point to another to give a rupturing capacity proportionate to the local short-circuit current available. As the Corporation supplies a large rural area, use has been found for switchgear no longer suitable for the urban network.

Small Steam Turbines

WE have become accustomed to regard the internal-combustion engine and generator as the only practicable alternative to the public mains for providing lighting and other small supplies, but it is reported from Germany that steam-turbine manufacturers are now entering this field with sets of less than 5 kW. In view of the small capacities for which heavy-oil engines are now being built there would appear to be little cause for their makers to fear steam competition.

What is "Evidence"?

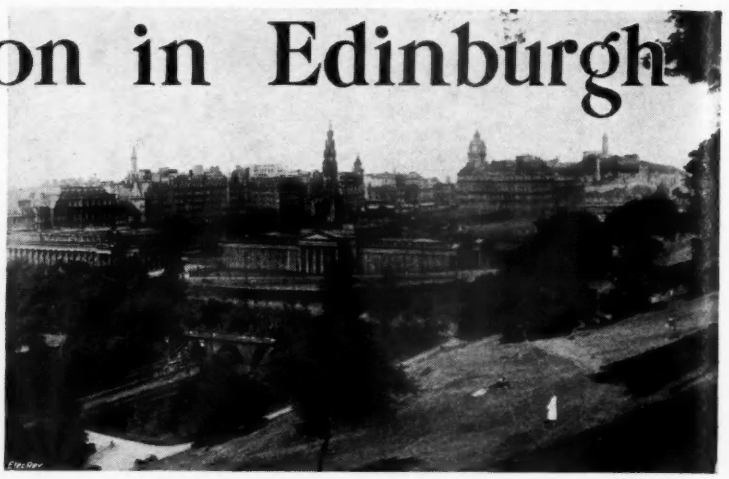
IN its latest Bill the Gas Light and Coke Co. seeks to force municipal authorities in its area to allow the company to install gas piping in their houses. Comment upon this can await the decision of the House of Commons Committee, which is considering the Bill, but reference may be made to the "evidence" which the company is producing. On Tuesday last it included the testimony of a bevy of women who came to express their preference for gas. The chairman (Sir John Ganzoni) eventually became a little restless and suggested that the opposers could call as many witnesses who preferred electricity to gas. So the company's Counsel agreed to stem the flow of these misguided females. If this was evidence then "what the soldier said" should certainly not have been ruled out.

Aspects of the Supply System in Edinburgh. **(See following page)**

1. A typical h.v. sub-station with five-panel switchboard. 2. Portobello turbine room. 3. Isolated transformers at a sub-station in a dense area. 4. L.v. sub-station lay-out; transformers on circuit-breakers, feeders on porcelain fuses. 5. A rotary converter sub-station. 6. An excellent meter-testing lay-out (Dewar Place).

Distribution in Edinburgh

Two distinct high-voltage systems



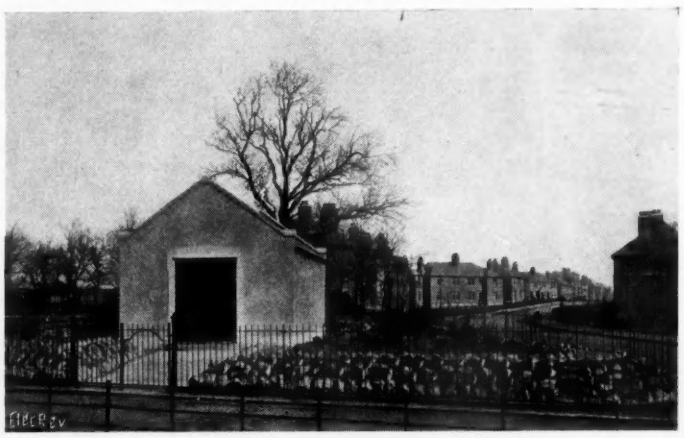
[Courtesy of L.M.S.

THE following notes are designed to show how the Edinburgh electricity undertaking is overcoming the high-voltage distribution difficulties, arising from present-day interconnections and load concentrations, of providing adequate safety without a disproportionate distribution capital cost. The h.v. network is supplied from Portobello power station at 6.6 kV. In 1927, when an extension of two 30,000-kW generating sets and five additional feeders was projected, calculation showed that, with the network as one unit, not only would the main switchgear in the station be operating slightly above its rated rupturing capacity, but a large proportion of the sub-station switchgear would be operating seriously above rating conditions. The problem set, therefore, was to plan a network capable of further modification should the power concentration at Portobello be further increased, preserving as much as possible of the existing switchgear. The solution was to form what are virtually two power stations and two high-voltage networks.

Each "station" feeds one network, and they are interconnected at one point through a set of 2,000-A reactors having a reactance of 15 per cent. on 20,000 kVA. The duplicate bus-bars at Portobello were utilised to form the two "stations," and the network was divided on a well defined geographical line, Princes Street in fact, so that the staff could think and speak clearly of the northern and southern networks. The station bus-bars were also renamed North and South.

While this was sufficient to meet the immediately projected conditions, it was realised that, with the advent of the grid connection and another generating unit, for which there was site accommodation, the network would require still further sub-division, although the main switchgear would be adequate.

The existing network was, therefore, modified as opportunities occurred, and all subsequent extensions were planned to facilitate a radial sectionising scheme by means of which each network would be divided into four sections, each normally independent of the others except for the fact that the energy would be supplied through a common set of bus-bars at the power station.



A sub-station in a residential area

These adjustments were sufficiently advanced by the summer of 1935 to permit of six sections being formed, and the remaining two will be effected this coming summer, thus completing the scheme.

Each section comprises from three to five main trunk feeders interconnected at their remote ends through a distribution network. Inter-section connectors have been provided which, while normally open at one end, may be used to augment the feed to a particular section in the event of loss of one of the main feeders. All the feeders are provided with unit protection of the balanced-current type to ensure that nothing but the faulty feeder is isolated.

Up to date the operating experience on these sectionised networks has been very satisfactory. The tie-line reactors are fitted with time-lag overload protection, and in the event of a sustained fault this serves to free one network and its associated "generating station" from the disturbance. We understand that on a recent grid fault this proved a valuable feature.

The plant supplying each network is chosen to minimise the current normally passing through the reactors, and by controlling the power factor at which this current is transmitted the respective sets of bus-bars are always maintained at equal voltages.

As each radial section is only connected to the remainder of the networks *via* the bus-bars, it is comparatively immune from the effects of faults on other sections. In the event of a major disturbance, involving the restoration of a partial supply or a full supply by stages, the control of each section is in the hands of the power station staff, who have instructions as to how such emergency conditions are to be met. It is, of course, impossible to visualise every kind of emergency condition.

Therefore, so that the operating staff may have the subject constantly before them and be aware of the correct procedure to follow for as many and varied contingencies as possible, the subject is reviewed from time to time at the staff meetings.

Economically, the scheme has been of considerable benefit to the undertaking. Sections have been chosen to make the best use of existing copper, and the power concentration at each sub-station has been kept within the predetermined limits, namely, 150 mVA, except in a few cases where special circumstances prevail.

In this way it has been possible to retain about 90 per cent. of the existing switchgear in its original positions, while part of the remaining 10 per cent. has been utilised in new positions where the ultimate concentration will not exceed its rated rupturing capacity.

For traction supply to the Corporation transport system there has been a recent addition to the rotary convertor sub-stations in the form of two remotely controlled semi-automatic rectifier stations. At the traction "subs," d.c. supplies are also given by rotary plant. The centre of the city is still supplied mainly from the d.c. system, but all the outlying districts have a.c. supplies at 400/230 V, the original single-phase system having been merged into the three-phase scheme.

The policy is to keep the d.c. non-traction load within the capacity of the existing converting plant, and this is accomplished by changing over some city consumers to the a.c. system and supplying new consumers or the increased demands of existing consumers from the newer system. There are about ninety-five static sub-stations in the area of 50 sq. miles, and about 180 miles of 6.6 kV cable has been laid.

In carrying out its policy the undertaking has kept in mind one particular point of major importance which is sometimes overlooked by distribution engineers, namely, that everything which is accomplished on the high-voltage network by way of preserving the power concentration within predetermined limits reduces the duty on every subsequent piece of connected apparatus right down to the fuses, switches and starters on consumers' installations.

We are indebted to Mr. E. Seddon, M.I.E.E., engineer and manager of the undertaking, and to his assistant, Mr. J. Eccles, for their help in the compilation of these notes.

Induction Heating. By J. Marryat

Application direct to the point

THERE has lately been a great increase in the direct electric heating of metal parts used in industry by means of heavy currents at low voltages, and the system, where applicable, has considerable advantages over the use of furnaces or muffles. This method of heating is highly efficient, as the whole of the heat is generated within the work, and there is no waste of heat such as accompanies the use of a furnace. The heating is also very rapid, preventing burning of the outer fibres of the material, which frequently takes place in an open forge. Parts heated in this manner are hotter at the core than at the outer surface, which increases the overall ductility, making them very suitable for subsequent forging operations.

In most cases the pieces are heated one at a time, and as the operation is carried out in the open, without any surrounding muffle, the operator is able to view the progress of the heating at every stage. In addition, an automatic current cut-off at any predetermined temperature can be easily provided. One of the earliest industrial applications was the electric rivet heater, many of which are now in everyday use giving very satisfactory results.

The principle underlying the design of the low-voltage heating machine is simple. A large-capacity transformer provides ample current for the particular purpose, at from 2½ to 6 V. The secondary winding usually consists of a single turn of heavy copper, the part to be heated forming a portion of this secondary turn. Special copper dies are used to hold the work, and these are shaped to make good contact over a large area. They are water-cooled to prevent the conduction of heat from the work to the transformer. This type of machine is most suitable for the heating of repetition parts and can be accommodated easily in a production line.

The bending of bars and pipes is satisfactorily carried out in this way, as a short length of material can be brought up to bending temperature in about thirty seconds; it is then removed and bent before passing to the next operation.

Another application to which this process has recently been applied is the heating of tyres for railway rolling stock. The tyre forms the secondary winding of the transformer, the core of which can be easily opened for insertion and removal of the tyre. The current induced in the tyre heats it very quickly, after which it is removed from the machine and shrunk on to the hub with the minimum delay. In this case the great advantage is the uniform heating which is very difficult to obtain with any other method.

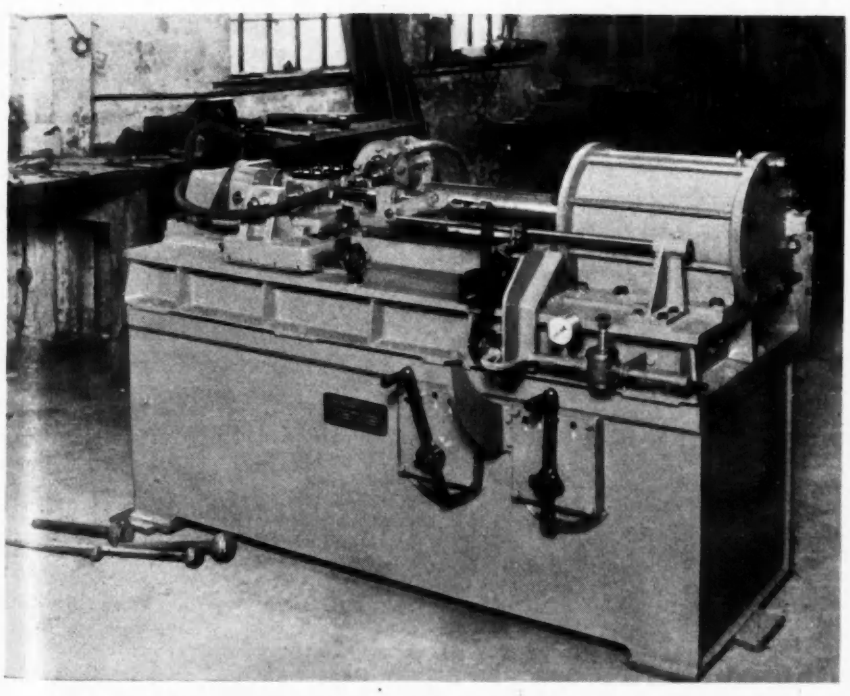
Steel tapes and wires are readily annealed after rolling or drawing by passing over roller electrodes connected to the secondary terminals of a low-voltage transformer. This is receiving much attention at present, as it forms a simple and rapid method of annealing with extremely accurate temperature control. Such control can be provided by tappings in the primary winding of the transformer, and also by variation in the speed of the material which is passing over the rollers.

Two 75-kVA tyre-heating machines

The low-voltage heating principle is the main feature of the electric upsetting machine. In this case, components such as motor-car valves, which consist of a forging at the end of a stem, are made from steel bars of the stem diameter. The bar, after being cut to length, is placed in a machine designed to heat it at the end, between two electrodes. As the temperature at the end of the bar rises, longitudinal pressure is applied to it by means of a pneumatically or hydraulically operated piston which pushes up more material into the heated area. In this way a bulb of hot metal is formed at one end, and while it is still hot, the part is dropped into the press and forged to final dimensions.

Almost all motor-car valves are now made in this manner, as also are brake-operating cams, hydraulic shock-absorber-rotors and other similar parts. Applied to the manufacture of such products, this system of heating is quite the most economical available since it is possible to save lengthy swaging and reheating processes previously used.

The economy and efficiency obtained by this method of applying intense local heat at any desired point is creating rapidly increasing interest in these machines, and it is the only system in which all the current used is dissipated in the part itself in the form of heat. There is little doubt that there will be considerable development in this type of industrial heating load during the next few years.



A 40-kVA electro-pneumatic upsetting machine for swaging 1¼-in. diameter steel bars

Very Low Temperatures

It has been decided to keen open the very low temperature exhibition at the Science Museum, South Kensington, until the end of June instead of the end of May as was originally intended. This will enable the exhibition to be visited by the delegates to the international congresses on welding, chemical engineering and refrigeration, which are being held next month.

Testing Current Transformers. By G. W. Stubbings, B.Sc.

A null method which does not require a phase-shifting transformer

THE following system of testing current transformers is of the comparison type, in which the difference between the unknown errors of the transformer under test and the known errors of a standard transformer are directly measured. The method is a null one, and the in-phase and quadrature components of the difference of the secondary currents of the test and the standard transformers is read off on the scale of a rectifier milliammeter, the impedance of which does not affect the accuracy of the test. The novel feature is that no phase-shifting transformer or other device for continuously varying the phase of a test voltage is required, the only changes of this test voltage being those which can be obtained directly from a three-phase four-wire supply.

A wattmeter carrying the difference of the two secondary currents is used as a null detector. The distinction between using such a wattmeter as a detector and as a means for measuring a difference current is very important. The wattmeter deflections obtained in the ordinary methods of current transformer testing are quite small, unless a very sensitive instrument of high impedance is used. Now, while small wattmeter deflections can only be roughly estimated, they can be annulled, and brought to zero with considerable accuracy. If, in the ordinary method of testing, increased sensitivity of reading is obtained by using a wattmeter of very low current rating, the high impedance of this instrument will impair the accuracy of the result, because the current in the instrument will, due to this high impedance, be materially less than the true difference of the secondary currents of the two transformers with their correct burdens.

Arrangements and Procedure

In the test to be described the primary windings of the test transformer and of a standard transformer of a like nominal ratio carry the same current, which is derived from a step-down transformer supplied, in series with an adjustable resistance, from a three-phase, four-wire system. The impedance of the low-voltage circuit of the step-down transformer should be as small as possible, and the regulating impedance in the primary circuit should be non-inductive, in order that the secondary currents of the current transformers may be approximately in phase with the supply voltage. The secondary circuits of the test and the standard current transformers are connected in the usual way for current circulation, the wattmeter W carrying the difference between the two secondary currents. The correct burdens for the two transformers are included in the secondary circuit. An auxiliary circuit is provided which comprises an adjustable resistance

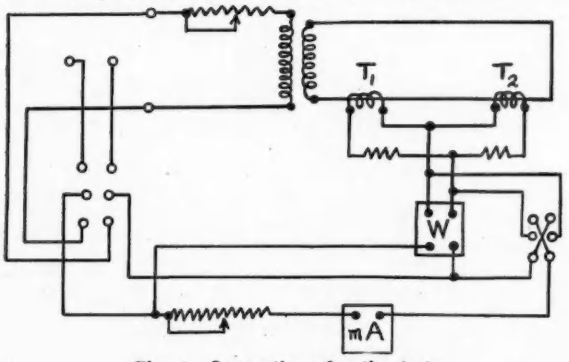


Fig. 1.—Connections for the test

and a rectifier milliammeter. This circuit can be supplied either by the voltage from which the testing current is derived, or by a voltage in quadrature therewith, derived from the terminals of the three-phase four-wire supply. The two leads corresponding to this auxiliary supply are connected to the wattmeter terminals, so that the current circuit of the instrument carries the resultant of the actual difference of the transformer secondary currents and the current supplied from the auxiliary circuit. The wattmeter is excited by the voltage which supplies the auxiliary circuit.

The test procedure is simple. The primary current of the test transformer is adjusted to the desired value, and the wattmeter W is excited by a voltage in phase with that supplying the step-down transformer. The reading of the wattmeter then corresponds to the in-phase component of the difference of the two secondary currents. The auxiliary circuit is supplied by the voltage that excites the wattmeter, and the direction and magnitude of the current in this circuit which passes into the wattmeter is so adjusted that the wattmeter reading is reduced to zero. The magnitude of the current in the auxiliary circuit as indicated on the milliammeter is then equal to the in-phase component of the difference of the two secondary currents, and the ratio of this current to the secondary current of the transformers, given by an ammeter in the main secondary circuit, is the difference between the two ratio errors. The supply to the wattmeter W and to the auxiliary circuit is then changed over to a pair of terminals which gives a voltage in quadrature with that by which the step-down transformer is supplied. The wattmeter reading is again reduced to zero by adjustment of the current in the auxiliary circuit, and the magnitude of the current shown by the milliammeter in this condition is the quadrature component of the difference of the two secondary currents. The ratio of the milliammeter current to the secondary current is the difference between the ratio and phase errors of the two transformers in radian measure.

Fig. 2.—Vector diagram

The theory of the test is also simple. In the vector diagram the two secondary currents of the test and standard transformers are OA and OB. The difference between these two secondary currents, AB, passes into the wattmeter W.

In the first test this wattmeter is excited by a voltage very approximately in phase with OA, and its reading, with no current in the auxiliary circuit, will correspond to the in-phase component AC of AB. The auxiliary current, being supplied by the same voltage as that which excites the wattmeter, is also in phase with OA. The value of this auxiliary current is adjusted to make the wattmeter read zero. The current in the wattmeter is now in phase quadrature with OA, and is represented by BC. The current from the auxiliary circuit which is injected into the wattmeter to produce this condition is evidently represented by AC, and is the in-phase component of the difference current AB.

In the second test, both the wattmeter voltage circuit and the auxiliary circuit are supplied by a voltage which is in phase quadrature with AB. The reading of the wattmeter with no current in the auxiliary circuit will correspond to BC, the quadrature component of AB (the difference current). When the auxiliary current is so adjusted that the wattmeter reading is zero, the wattmeter current is CA, and the current injected into the wattmeter from the auxiliary circuit is represented by BC.

By means of this method, therefore, the in-phase and quadrature components of the difference current AB are directly measured on a milliammeter, with an evenly divided scale, which may be of any desired sensitivity; its impedance has no material effect on the accuracy of the test.

Possible Source of Error

The legitimacy of this test depends upon phase coincidence of the auxiliary current with the secondary current of the test transformer. Any departure from this condition will affect the accuracy of the ratio-difference test, and assuming that the test voltages are shifted in phase by 90 deg. for the phase test, the accuracy of this test will be likewise vitiated. Provided that the impedance of the secondary circuit of the step-down transformer is very low in relation to the equivalent primary resistance, this possibility of error is not serious, because the lag of the primary current of the step-down transformer of the supply voltage tends to be compensated by the lead of its secondary current on the primary current. The phase difference of the actual primary currents of the transformer under test and the supply voltage can be measured by means of a wattmeter in the secondary circuit of the current transformer excited by the quadrature voltage of the three-phase supply.

The extent of this phase shift will be equal to arc sin W/IV. Provided the phase shift does not exceed 5 deg., it can be shown that the error which it causes is not likely to be more than ten per cent. of either the ratio or phase error differences. As these differences will not, as a rule, exceed one per cent., the actual inaccuracy will be of the order of 0.1 per cent. only.

Due, however, to this possibility of inaccuracy, the method of testing described is most suitable for current transformers of low rating, so that ample resistance can be included in the primary circuit of the step-down transformer to avoid any but a small phase difference of the secondary current of this transformer and the supply voltage.

Rural Cable Systems.

By P. V. Hunter, M.I.E.E. & H. J. Allcock, M.Sc.

The economic use of underground instead of overhead feeders

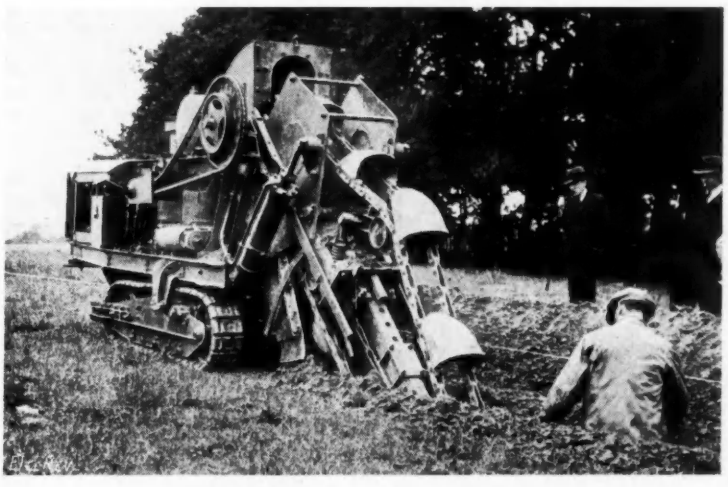
IT will generally be acknowledged that if the use of underground cables can be justified on economic grounds, they are preferable to overhead lines in view of their relative freedom from interruption, absence of interference with amenities, and generally better electrical performance. As an instance of the last attribute it is interesting to compare the voltage drop of an 11-kV 0.05 sq. in. three-core rural cable (the design of which is discussed later) with that of the equivalent steel-cored aluminium overhead line. When delivering 1,000 kVA over a distance of 15,000 yards at 0.8 power factor at a pressure of 11 kV, the voltage drop of the underground cable is only 6 per cent., as compared with 8.05 per cent. in the case of the equivalent s.c.a. overhead line.

The only criticism which is offered against the cable network is the assumed adverse effect of the charging current, but this has produced no difficulties in practice. The advocate of the overhead line usually considers the effect of charging current under conditions of light load, and assumes that there is no other load associated with rural supply. But in these days of interconnection the supply will always be associated with other loads in addition to the purely rural one.

Inquiries which we have made in Holland, where rural electrification is very highly developed—almost entirely by the use of underground cables—indicate that the capacity current of the rural system has produced no difficulties. In one case, the cable system comprises 1,200 km. of 10-kV cable, and the peak load is 45,000 kW. In addition to supplying the rural areas, the power stations also supply the general load of the towns and industry, which has a steadying influence on the power station bus-bar voltage during the night when, so far as the rural network is concerned, there would be little load other than that due to the capacity current of the network. Conditions such as these apply also throughout the country. In fact, owing to the existence of the grid, the effect of the capacity current of a rural network on the power station or main grid voltage would be quite inappreciable; and no adverse effect would be likely to be felt if much greater use was made of underground feeders.

If in order to obtain the advantages enumerated above, cables are to be used, it is obvious that a reduction in overall cost of the underground feeder is necessary. Recent progress has, therefore, been along two lines, first, the development of a new standard rural cable of cheap and reliable design, and secondly, the reduction of the cost of installation.

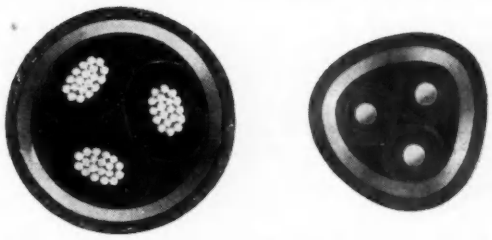
It is recognised that rural lines are designed rather on consideration of voltage drop than of current-carrying capacity, so that the conductor temperature rises involved are very small; this permits the use of smaller thicknesses of dielectric than are necessary in the urban cable, which, on much shorter runs, is heavily loaded and may have to work with a maximum conductor temperature rise of 50 deg. C. The new rural cable is of the three-core screened type, having 0.05 sq. in. shaped conductors and a dielectric thickness of 0.10 in. between conductors and screens, instead of the normal 0.14 in. called for by B.S.S. No. 480-1933. Moreover, armouring has been omitted in order to reduce the cost and weight of the cable as, even with the cable laid at a depth of 2 ft. only, there will be freedom from mechanical damage, except in abnormal circumstances, since the maximum depth of normal working of the soil—even of deep ploughing—is only about 12 in.



A trench-digging machine in operation

It is only necessary to protect the lead sheath from chemical corrosion, and this can best be done by covering the cable with bituminous compounds divided into layers and held in position by means of tapes made of fibrous materials. A finish which has been proved satisfactory, both under accelerated life tests and in service, consists of two paper tapes, one cotton tape, and one hessian tape, all impregnated in and served with special bituminous compounds, recently developed, which retain indefinitely their waterproof and corrosion-proof qualities. The overall diameter of this cable is 1.35 in., and the weight approximately 29½ cwt. for a normal factory length of one quarter-mile. The maximum guaranteed loading of 1,500 kVA results in a rise of the conductor temperature of only 13 deg. C.

For teeing off from the main cable for individual services, an 11-kV cable of smaller conductor size has been developed. This is a three-core 0.016 sq. in. screened-type cable, each conductor consisting of a single circular copper wire 0.144 in. in diameter. The thickness of dielectric is again 0.10 in. The cable is of the "S.O." type; that is, it is covered with a "triangular" lead sheath, with rounded corners, instead of a circular lead sheath. The cable is finished in the same manner as the main rural cable, with two paper tapes, one cotton tape, and one hessian tape. This smaller cable is rated for a loading of 500 kVA, giving a conductor temperature rise of 7 deg. C.



Left: An 11-kV, 0.05 sq. in., three-core cable. Right: A "triangular" 11-kV, 0.016 sq. in. cable

The factors of safety of these two cables are very high, as evidenced by their asymptotic breakdown values—that is, the voltage at which the voltage/time-to-breakdown curve has become parallel to the time axis. For the 0.05 sq. in. cable this value is 43 kV between phases; while for the 0.016 sq. in. cable, due to the fact that the conductor is a single circular wire and not a strand, it is much higher, reaching a value of 69 kV between phases.

Furthermore, there is a growing tendency in new schemes to dispense with the intermediate distribution network at 11 kV, and to transform direct from 33 kV to low voltage. This has been rendered an economic possibility by the recent considerable reduction in the cost of small transformers for the purpose. Consequently, development is at present being carried out on a three-core 0.05 sq. in. 33-kV cable, with a reduced thickness of dielectric, which again is justified in view of the fact that the loading at 33 kV can only be very light. Although it is somewhat early to make definite statements regarding this cable, lengths of which are at present undergoing exhaustive tests, it is confidently anticipated that a considerable reduction in cost will ensue, so that rural transmission at 33 kV by means of underground cables will become an economic possibility.

In order further to reduce the cost of the finished line, it is intended that these rural cables should be laid in straight lines directly across country, sited in more or less the same way as overhead lines; and, to obtain the greatest economy, mechanical means of excavating and laying the cables are being employed.

Trench-digging machines have been designed and built and have been found capable of operating satisfactorily in most soils except, perhaps, very heavy clays or flint-bearing soils. The normal size of trench suggested for rural distribution schemes need be only 2 ft. deep by as little as 8 in. wide, and such a trench can be excavated mechanically at a rate of half a mile in a working day of eight hours, allowing for the normal number of obstructions such as road crossings, hedges and ditches. The cable drum is mounted on a carriage with

caterpillar tracks and drawn by a tractor, and this runs along the route astride the trench, the cable being paid off from the drum into the trench as the tractor and carriage advance.

In order to supplement the trench-digging machine, and so make use of mechanical and economic methods of laying in those types of soils where such a machine is at a disadvantage or large buildings are present, a special form of cable plough has been proposed by Sir Bernard Greenwell and is at present under development by the County of London Electric Supply Co. The great advantage of this plough over the mole drainer is that the cable is not drawn through the duct formed by the mole. As the walls of the duct are by no means of solid construction, the longitudinal stresses imposed on the cable with the mole drainer may be very high.

There is usually great difficulty in making a general comparison of the capital cost of overhead lines and underground cables, because the two methods are affected very differently by the nature of the route. All that can be said truly about such general comparisons is that they can never be a safe guide to the comparative cost of overhead and underground work in connection with any particular route. We would suggest that the only way in which such a comparison can be made in connection with an actual route is to obtain quotations from responsible contractors for carrying out the work by both methods, after an inspection of the site. If this is done, it will usually be found that generalised figures are quite misleading. It is possible to state, however, that in the case of recent contracts for cables laid across country the following costs per mile were realised :—

Route No. 1.—Cross-country line 3¾ miles long; trench work, excavated by machine, including the reinstatement of the surface, the disposal of surplus soil, laying and jointing, £507.

Route No. 2.—Cross-country line 11¾ miles long; trench work, excavated by machine, including reinstatement, disposal of surplus soil, laying and jointing, £492.

These figures compare with a cost of £354 per mile for the equivalent s.c.a. overhead line given in a recent paper* read before the I.E.E.

There is another important consideration which must not be lost sight of, namely, that in making a comparison of the two different systems, the questions of maintenance and depreciation are usually of more importance than that of capital cost. Broadly speaking, the cost of maintaining underground cables is less than that of overhead lines, although both figures are comparatively small. The important figure is the length of life which may be expected from either system and, in this connection, it may be noted that in Holland it is customary to take the life of the cable as 60 per cent. longer than that of an overhead line. On this basis the annual charges for the underground feeder would be less than those of the overhead line.

It may be confidently maintained, therefore, that in the case of cross-country routes, where the laying of cables can be carried out cheaply by mechanical means, the advantages to be obtained from the underground feeder, even if the initial cost is somewhat higher, justify its use in place of the overhead line. Examination of individual routes show this to be the case in the great majority of rural schemes which have to be carried out in this country.

*Ross, D. "A Review of Recent Developments in Rural Electrification." I.E.E. *Journal*, Vol. 77 (pp. 797-811). December, 1935.

A Cable-laying Plough. By Sir Bernard E. Greenwell, Bt.*

THE cable-laying plough referred to in the article by Messrs. P. V. Hunter and H. J. Allcock was evolved as the result of experiments made by the County of London Electric Supply Company in the use of a 4½-in. diameter mole plough with a 6-in. plug to enlarge the hole for the purpose of threading or drawing in cables and, subsequently, the laying of cables into the soil. The original model was made at Marden Park out of inch angle iron, welded together to support a cutter, which was shaped like a mole plough, and this model successfully laid by means of hand power a piece of 1-in. rope in a sand pit. The successful operation of the model justified the development of the idea, and the County Company's engineers produced the plough now described.

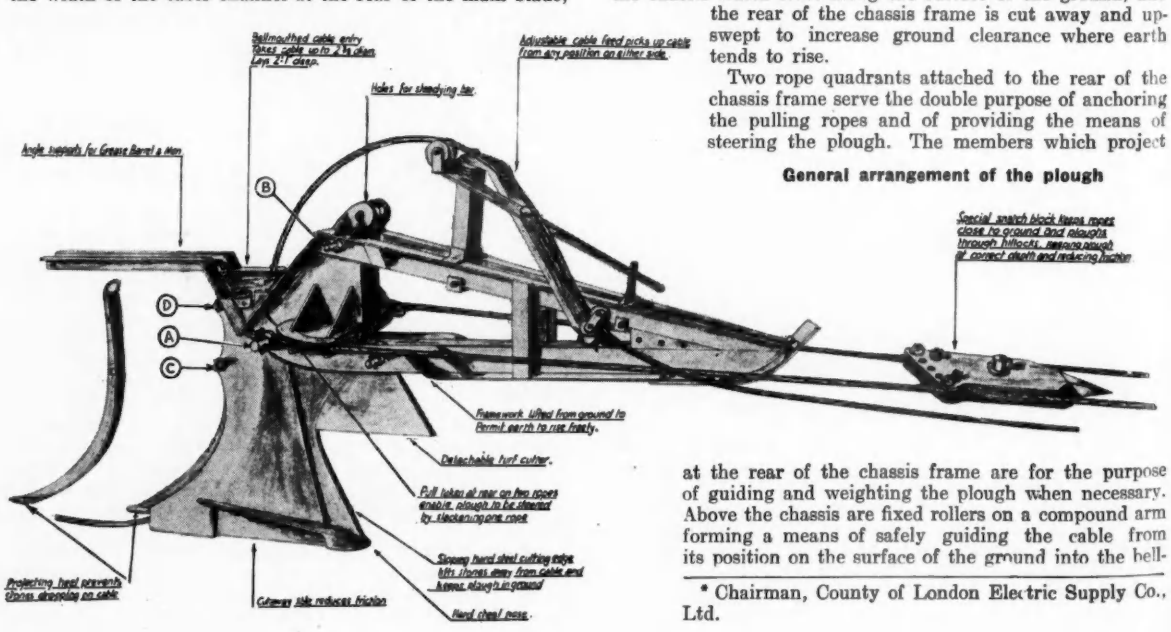
The plough consists of an inclined cutting blade, which has a leading edge of hardened steel, widening towards the rear of the blade to form a channel from the surface to the base of the blade, large enough to admit the cable to be laid. The model illustrated is suitable for cables up to 2½-in. diameter, and the dimensions of the main blade are such that the cable may be laid 2 ft. below the surface.

A steel nose is formed at the base of the main blade, the point widening out rapidly, so that its width exceeds slightly the width of the cable channel at the rear of the main blade, and this formation, together with the slightly sloping blades shown, tend to prevent the plough blade rising out of the ground, further assisted by the rake of the leading edge together with the rake of the secondary cutter shown in front of the main cutter. The purpose of the secondary cutter is to cut cleanly any turf and surface roots that may be encountered, and its position relative to the main blade ensures that this is done before the surface is disturbed by the uplift of earth caused by the steel nose of the main cutter.

The chassis frame to which the main and secondary cutters are attached, consists of angle iron, and the attachment of the main cutter to this chassis is by means of two pins (a) and (b) on the drawing. The removal of pin (a) leaves the cutter free to pivot about pin (b), so that when the plough is buried, a forward motion of the chassis frame after the removal of pin (a) causes the main cutter to rise to the surface of the ground. The rear of the curved channel containing the cable to be laid, is closed by a curved tee iron, which is secured by means of two pins (c) and (d), both of which are above the ground level, which enable the cable to be freed from the plough when this is buried.

There is an upward curved sole plate at the forward end of the chassis which rides along the surface of the ground, and the rear of the chassis frame is cut away and upswept to increase ground clearance where earth tends to rise.

Two rope quadrants attached to the rear of the chassis frame serve the double purpose of anchoring the pulling ropes and of providing the means of steering the plough. The members which project at the rear of the chassis frame are for the purpose of guiding and weighting the plough when necessary. Above the chassis are fixed rollers on a compound arm forming a means of safely guiding the cable from its position on the surface of the ground into the bell-


Bellmouthed cable entry takes cable up to 2¾ diam. Lays 21" deep.
Adjustable cable feed picks up cable from any position on either side.
Holes for steadying bar
Angle support for Grease Barrel & Man
B
D
A
C
Special snatch block keeps ropes close to ground. And ploughs through hillocks, ensures plough at correct depth and reducing traction
Framework lifted from ground to permit earth to rise freely.
Detachable turf cutter.
Pull taken at rear on two ropes enables plough to be steered by slackening one rope
Sloping hard steel cutting edge lifts stones away from cable and keeps plough on ground
Projecting lugs prevents chains disrupting on cable
Gateway idle reduces friction
Hard steel nose.

General arrangement of the plough

* Chairman, County of London Electric Supply Co., Ltd.

mouthed cable entry at the top of the cable channel. Two ropes from the rope quadrant are passed forward to a specially designed snatch block, which is fitted with several alternative anchorage positions for the ropes, and a modification of these creates a tendency for the plough to deviate from a straight line when negotiating large radius bends. The total removal of one of the wire ropes causes the plough to swing through an angle of approximately 45 deg., which is the method employed for turning small radius corners. The front of the snatch block is arranged to act as a surface plough for the removal of small obstructions, to ease the progress without loss of depth of the main tool.

Laying cables through a 3-in. "Tarmac" footpath, subsoil gravel, and flints and chalk

The operation starts by the excavation of a hole large enough to sink the plough so that the chassis frame rests on the surface of the ground. The tee iron covering the cable channel is removed, and the cable, previously run out along the intended laying route, is inserted, and its end is anchored at the base of the plough in a manner to withstand a pull of about 30 or 40 lb. The cable channel is then closed. A tractor fitted with an engine-driven winch is placed on the route and anchored, so that, by means of the winch and wire ropes, the plough is hauled along the route, laying the cable as it proceeds.

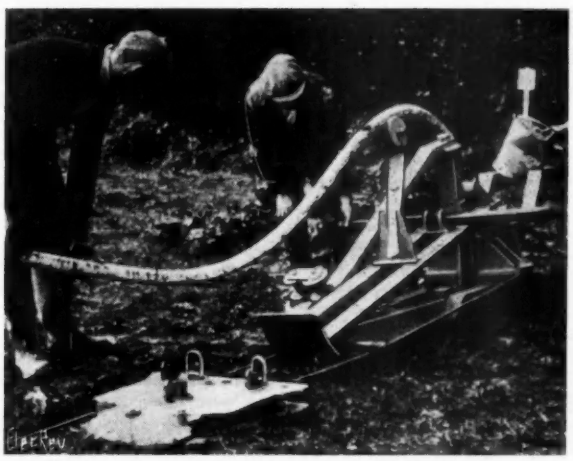
During the burying process the cable is protected from abrasion by the steel housing of the cable channel, and is stationary relative to the ground when it emerges from this channel. If the cable is properly fed into the mouth of the channel, the tension load on it is only of the order of 30 lb.

When convenient, a hole is excavated at the position where the joint will occur between the first and second lengths of cable, so that the second length can be threaded into the cable channel after the first length has been laid. This excavation has to be made in any case for the joint position, and the lengths are, of course, laid with an overlap for jointing purposes. Where the prior excavation of this hole is not convenient, the end of the first and the commencement of the second length of cable may be lightly lashed together with the necessary jointing overlap, and as the depth of the cable channel is double its width, the double cable may be laid direct in the ground and the hole for the joint excavated afterwards.

The whole of the plough and chassis frame is arranged so that it can be readily dismantled for transport. It can be easily handled by four or five men, as the total weight of the assembled plough and chassis frame is about 10 cwt. The draft required to pull the plough varies between about 3½ tons in light loam at approximately 60 or 70 ft. per min., and 15 tons in solid chalk with flints at about 25 or 30 ft. per min.

The cutting edge of the plough is quite capable of cutting through normal obstructions such as small tree roots, and if, for any reason, an insurmountable obstruction exists, such as a large tree root or a log of wood, which is beyond the power of the tractor, then excavation for its removal is greatly assisted by first of all removing the back guide of the cable channel, removing pin (a) and continuing to pull the plough. The effect is to cause the plough to rise out of the ground, thereby creating a considerable ground disturbance, enabling the obstruction to be readily located and removed.

The plough has been used by the County Company for laying, in the aggregate, about twelve miles of standard types of cable, through various types of soil, along footpaths, verges of roads, and across fields, with most satisfactory results. It creates the minimum amount of surface disturbance; experience has proved that disturbance does not extend beyond one foot in width with unpaved surface, 18 in. through tarmac surfaces, and 6 or 7 in. through agricultural land. A travelling speed or 30 to 70 ft. per minute can be maintained, the lower speed applying in the case of chalk and flint subsoils, and the higher through clay and loamy soil.



Cable being fed into the plough, which is traversing a field

The average cost, based upon experience so far gained, works out at 1s. 2d. per yard of cable laid, which includes operating costs and standing charges, exclusive of cable cost.

Power Plant at a Kent Colliery

CHISLET Colliery, about five miles from Canterbury, is 1,350 ft. below the surface, and it has a weekly output of about 10,000 tons of coal. The colliery power equipment includes two G.E.C.-Fraser & Chalmers turbo-alternator sets rated at 1,000 kW, 3,300 V, 3-phase, 50 cycles. One set is directly coupled to run at 3,000 r.p.m. The other is geared, the turbine speed being 6,000 r.p.m. and that of the alternator 1,500 r.p.m. Both are of the mixed pressure type, l.p. steam being taken from two reciprocating engines driving air compressors.

The two Fraser & Chalmers steam-winding engines are of the direct acting cross-compound type; a new F. & C. turbo-compressor will supply the whole compressed air demand of the mine. The reciprocating compressors are to be retained for stand-by purposes and the turbo-alternator sets will then utilise the exhaust steam from the winding engines.

From the main switchboard 3,300-V feeders supply the larger motors (*i.e.*, over 50 h.p.) and also transformers, which step down to 550 V for the smaller motors.

Electrically driven plant at the surface includes a river pump for the condensing plant, the main ventilating fan, a number of small screens, creepers, &c., and a motor-generator set for lamp accumulator charging. The pump is driven by a 100-h.p. squirrel-cage motor. The main centrifugal fan, which ventilates the whole of the underground workings, is chain-driven at 185 r.p.m. by a 150-h.p., 3,300-V G.E.C. synchronous induction motor running at 600 r.p.m. The synchronous motor also corrects the low-power factor due to the induction motors used in other parts of the colliery. Its input at full load is 312 kVA at 0.424 leading power factor, so that it is capable of improving the p.f. of a load of 1,000 kW from 0.65 to 0.8. A Brown-Boveri regulator automatically maintains constant p.f. at all loads. Also equipped with G.E.C. motors are four screens and two creepers driven by 20-h.p. motors, two further creepers with 10-h.p. motors, and a retarder with a 2½-h.p. motor.

Underground haulages, creepers, &c., are equipped with upwards of thirty G.E.C. induction motors ranging up to 200 h.p.; both squirrel-cage and slip-ring motors are used, the latter with flameproof slip-ring covers. A 550-V supply for motors of 50 h.p. and under is controlled by a four-panel G.E.C. distribution board.

The largest underground haulages are of the main-and-tail type and run at a rope speed of 8 m.p.h. Two are gear-driven by 200-h.p., 725-r.p.m. slip-ring motors, while the third has a 150-h.p. motor. Five further main-and-tail haulages are equipped with one 110-h.p., two 85-h.p. and two 50-h.p. slip-ring motors.

One of two endless rope haulages is driven by a 100-h.p. squirrel-cage motor and the other by a 25-h.p. slip-ring motor. The 100-h.p. motor is reversed in emergency by a special type of selector switch incorporated in the circuit-breaker.

Carrier-current Control

Dealing with large networks

METHODS of effecting carrier-current control over large networks can be divided into two classes: (1) Those depending upon the installation of a separate emitter in each sub-station in which the high-frequency signals do not pass through transformers between the emitter and the point of reception of the signal current. (2) Those which permit of the installation of a single emitter at the high-voltage bus-bars, suitable for large areas, the high-frequency signals passing through intervening stages of transformation.

The first method, if applied to a large network with perhaps many hundreds of sub-stations, would require an approximately equal number of emitting equipments to cover the network and prevent complete centralisation of control. Furthermore, such a method usually depends upon the use of the system low-voltage neutral to convey the carrier current, the return path being *via* earth. This principle was first suggested in 1897, and has been applied in certain cases with some success as a means of controlling street-lighting systems without the aid of separate switches, individual services or continuously running mechanism. The chief object was to avoid the labour cost of hand switching or to avoid incurring the heavy expenditure otherwise necessary in laying new services when conversions from gas to electricity were undertaken, but the advantage of centralised control with sudden fogs was also recognised.

An Alternative Method

For extensive a.c. networks the "Actadis" method devised by Mr. Bethenod provides an alternative If, at the station bus-bars, a three-phase high-frequency current is emitted on to the feeders at a voltage of, say, 10 per cent. of the feeder voltage, then the r.m.s. volts at 50 cycles will not be sensibly altered; and the high-frequency currents will traverse not only the high-voltage system, but will pass through the sub-stations and be transformed on to the four-wire low-voltage systems exactly as is the 50-cycle load.

Losses in the 50-cycle transformers at, say, 500 cycles, are fairly considerable, but this in itself is not a serious difficulty as only a very small power is required to operate the relays, and the amount can be prophesied and is constant, being a measure purely of the load and the reactance and capacitance of the system. Provided sufficient power is emitted, the signal always reaches every low-voltage point on the whole network.

The principle of the system consists in emitting a three-phase, musical-frequency current (between 300 and 800 cycles) in series with the feeders, either singly or group by group. The emissions can be sent successively on sections of load up to 10,000 kVA at a time, *e.g.*, on feeders of this rated capacity per set. As the emissions are made in series with the feeders, the carrier voltage is dissipated solely on the consumers' side of the bus-bars and cannot cause appreciable carrier currents to flow *via* the transmission lines into an interconnected system.

The reason for this is that if the signal is emitted at any point below the station bus-bars in series with the feeder, the ratio of the voltage drop above and below the point of emission is measured by the ratio of the impedance presented below and above the point in question. As the impedance across the bus-bars of any generating station is exceedingly small, they may be regarded as being short-circuited at carrier frequencies, and no emission voltage can emerge across the terminal or feeder which interconnects the system upon which the signals are being sent with another system upon which signals are not required.

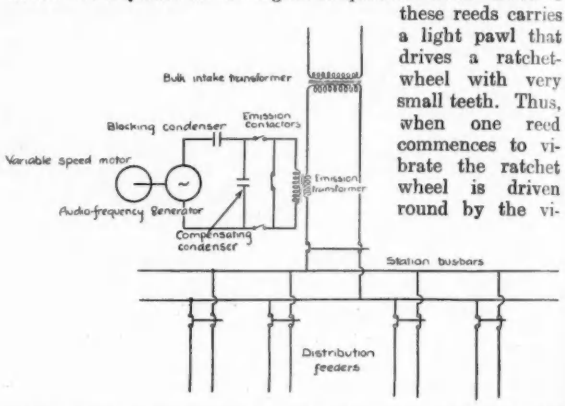
In the "Actadis" system carrier currents are generated in a three-phase high-frequency alternator, the speed of which is proportional to the signal frequency required. The signal currents are then passed through condensers, which not only prevent the passage of 50-cycle currents from the network through the high-frequency alternator, but also reduce the magnetising current in the emission transformers. The latter have one set of windings permanently connected in series with the feeder and the other delta-connected to the musical-frequency generator. When they are energised, musical-frequency current flows through the network, both high- and low-voltage, and will operate any number of relays.

The Relays

Different signal frequencies are generally used for each remote operation; thus an ordinary on- and off- operation (as for street lighting) requires two frequencies, separated by about 60 cycles per second; this provides positive discrimination between signals.

If a single frequency were used, cyclically, to perform an on-off operation (*i.e.*, a repetition of the initial "on" signal causing the relays to go "off") breakdown of the emitter might result in the operation of only half the relays, which would then be out of step, and would have to be manually re-set.

An "Actadis" relay for two-frequency operation consists of a filter circuit, designed to pass only carrier frequencies and to block 50 cycles, feeding an electro-magnet which has two vibrating armatures, the periods of mechanical vibration of which are adjusted to the signal frequencies used. Each of these reeds carries a light pawl that drives a ratchet-wheel with very small teeth. Thus, when one reed commences to vibrate the ratchet wheel is driven round by the vibratory impulses, and, by the intermediary of gearing, drives a mercury contact. The second reed (for performing the reverse, or off, operation) drives the small assembly in the opposite direction.



Arrangement of an emitter for networks up to 10,000 kVA fed by bulk supply

An effective safeguard against accidental operation, or creeping, is provided by a small centrifugal clutch, which ensures that unless the reeds are vibrating at a speed approximately synchronous with the carrier signals, the drive cannot be transmitted to the contact.

The relay can be housed in a small space. Over a period of years, the number of failures in operation amounts to only 0.002 per cent.

Carrier emitters operating directly from the power station, and giving two, four, eight or more signal frequencies are now available; thus, the same apparatus can, in addition to providing control of public lighting, be used for such purposes as off-peak switching for water heating systems or other thermal loads.

The system as a whole can be applied to networks varying from about 300 kW up to 250,000 kW, the same technique (with variations purely in size of equipment) being applicable to all networks. The signals can be injected into networks of any voltage, up to the highest normally used. The apparatus used in this country is being manufactured for Actadis, Ltd., by Messrs. A. Reyrolle & Co., Ltd.

High-voltage Testing Apparatus

In a recent issue of our Austrian contemporary, ***E. u. M.***, Herr Engelbert Wist gives some details of the new laboratory for tests up to 1,000,000 V. which has been established in connection with the well-known Technical High School in Vienna.

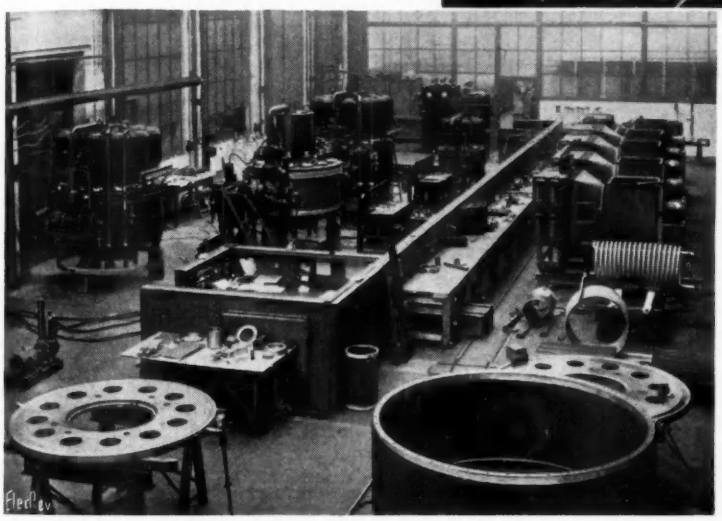
A feature of the installation is that the walls of the laboratory and of the adjoining machine room are covered with a metallic trellis, the meshes of which are connected, by welding, to electrical conductors. The trellis, which forms a kind of Faraday cage, is connected to a copper cylinder approximately 32 in. in diameter and 39 in. in height, with walls 3 mm. in thickness; the cylinder is located in a walled pit in the ground and it is immersed in water which rises from below the laboratory.

The equipment includes an alternator driven by a d.c. motor, arranged to generate at 1,200, 2,500 or 5,000 V at frequencies between 15 and 50 cycles, and two banks of five bakelite-insulated condensers designed to withstand 110 kV. After being charged this impulse generator can be connected in series by a special automatic device. At 1,000 kV power to the extent of 1,000 joules can be developed. High-frequency tests are carried out by Tesla equipment at 1,000 kV and 60,000 cycles.

The sparking spheres are supported on telescopic aluminium hollow columns 32 in. in diameter. The equipment of the laboratory also comprises a Braun tube, thyratron apparatus for the study of oscillations, a cathode-ray oscillograph, and a high-speed cinematograph recorder for taking photographs of oscillation speed variations.

Fabricated Machinery Developments

Extensive work on large-scale equipment and conversion apparatus in the Edinburgh works of Messrs. Bruce Peebles & Co., Ltd.



Steel-cylinder equipments being assembled and "formed" in the rectifier shop (left), and (above) the welding department

TWO things which arrested our attention most during a walk through the electrical shops at the works of Messrs. Bruce Peebles & Co., Ltd., Edinburgh, were the very extensive fabrication work that is now being done for really large equipment and the great amount of a.c. to d.c. conversion equipment—both rotary and static—that is being made. Is the latter just one of the results of industrial revival, or does it mean that there is a reversion of d.c. in progress in the factory? Comments from some of our more informed readers on this question would be helpful to many others.

We saw, in various stages of construction, two 1,000-kW, one 1,750-kW, and three 1,500-kW rotary convertors for the Aberdeen, Blackpool and Birmingham supply undertakings respectively, a 1,500-kW set for the Tata Iron & Steel Co. (India), and a similar machine for Messrs. Brown Bayley's works at Sheffield, a 500-kW machine for the Consett Iron Co. (Durham), and a 500-kW set for Harrods' Stores (London). The bed-plate of the last-mentioned machine is constructed in two parts, bolted together, to facilitate erection of the machine in the basement. A recently completed 1,500-kW self-synchronising motor convertor is designed to operate direct off an 11-kV, 50-cycle, 3-phase supply and to give a continuous output of 2,900 A at 525 V d.c. at 600 r.p.m.

In most departments, too, we saw evidence of the fifty-seven steel-cylinder rectifiers which are now being made for the Southern Railway. Each of these has a normal capacity of 2,500 kW and can deal with a momentary load of 7,500 kW. In the welding shop the difficult job of welding together the two sections of an anode plate was being carried out, while in the rectifier shop we saw S.R. equipments being "formed." This specially planned and equipped shop, however, is devoted almost exclusively to the erection of rectifiers, the actual production and machining being carried out in the welding and machinery departments.

The fabrication (welding) shop actually provides constructional service for the rectifier, transformer and rotating machinery shops. Both a.c. and d.c. welding are employed, and about the walls can be seen specially designed blade-type tapping switches for the a.c. equipment, which operate with a rotary movement of the blade contacts. Perhaps the most interesting apparatus in this department is the new oxygen-flame cutting machines which leave the "cut" with almost a "machined" surface—on really thick steel plate, too. The flame projector below moves in the horizontal plane in conformity with the movement of a motor-driven pantograph over a pattern on a table above.

An outstanding example of fabricated construction is a 2,500-h.p. synchronous s.r. induction motor which has been made for the Ogilvie Flour Mill Co., Ltd., Canada (0.9 leading p.f., 3-phase, 60 cycles, 2,300 V, 133 r.p.m.). Although a contract condition was that the motor should start against 2½ times full load, on test a starting torque of 7,500 h.p. was obtained. The machine will synchronise against 100 per cent. overload, and its slip is so small that when full speed is attained and the excitation is applied the rotor immediately "pulls" into synchronism automatically. It is self-ventilated. The hexagonal 1¼-in. steel plate stator frame consists of two end pieces and a centre rib held together at the outer periphery by 1-in. plates located at equidistant points, and by 3-in. plates forming the jointing faces where the frame is "split" at the horizontal diameter to facilitate transport and erection on site.

Fabrication is also a leading constructional feature of a new range of "steel clad" a.c. motors developed by the company for hard service conditions, such as those which prevail in

Rotating machinery department

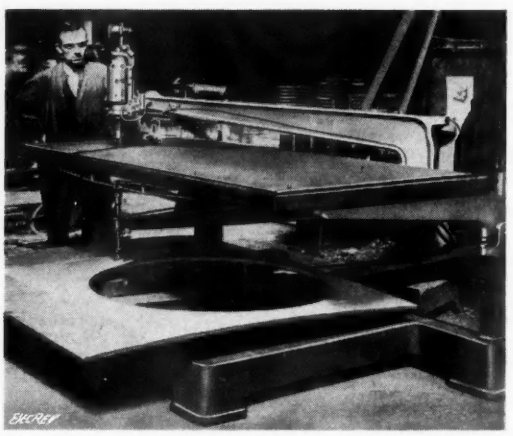
mines, steel works and quarries. These motors are designed with maximum protection for all vital parts, while retaining the advantages of free air ventilation, and ability to stand up to sudden variations of load. Made in sizes up to 2,000 h.p., they virtually represent an extension of the company's "G" and "H" motors, but they have special structural features on account of their larger size in relationship to the severe duties for which they are produced.

They are made of substantial steel plate, welded, of course, and the construction of the stator frames, with louvres extending axially over their complete length, ensures thorough ventilation and prevents the ingress of foreign matter. The motors have end-hood pedestal bearings, the pedestals being mounted on very substantial bases securely braced from the steel-plate end brackets. A further contribution to these efforts to attain maximum rigidity, minimum vibration and permanent alignment is the provision of end bracket spigots on the outer periphery of the brackets. Tapped holes around the bracket will receive the fixing bolts for use as jack screws for bracket withdrawal.

Concerning driving units, however, we should say that by far the most interesting development, technically at any rate, is the internally motor-driven pulp beater roll which has been designed in conjunction with a large paper-manufacturing concern.

The specially constructed motor and its gearing are actually situated inside the roll, so that the whole forms a self-contained unit. The motor is rigidly supported between two hollow trunnions which are anchored in the beater trough, the stator frame thus being held in a stationary position. The rotor is free to revolve on its own shaft. The motor has a driving pinion which meshes with two idle pinions, and these, in turn, mesh with an internal toothed rim fitted round the inside of the roll. The driving-end bearing and the motor are located outside the pinions, so affording maximum accessibility.

The gears are oil lubricated, while the main beater-roll and the motor bearings are grease lubricated by means of pipes passing through the hollow trunnions into which cooling air is drawn and from which the heated air is expelled at the opposite ends, respectively, by means of a fan. It is claimed that compared with the exterior drive for beater rolls, there is a saving effected in consumption of from 7 to 10 per cent., and that the operation working time is reduced by 25 per cent. Improved quality in the product is also obtained as the result of the added weight of the motor and because of the uniformity of pressure between the roll and the bedplate. Then, of course, the additional floor space which would be taken up by an external drive is saved.



An oxygen-flame cutting machine

All the transformer tanks are fabricated too, and to see operations in the welding shop on the large tanks of the four 15,000-kVA, 132,000-V, transformers which are now being built for the Central Electricity Board is impressive indeed. These represent one limit of the wide range of equipment for which the transformer shop is laid out, the other limit being pole transformers. Among the other present transformer contracts of which we saw evidence in the shops are a number of 1,000-kVA equipments for the Edinburgh and Aberdeen supply undertakings, a 6,000-kVA unit for the Fife Electric Power Co., a 3,750-kVA transformer for Nova Scotia, and two of 2,000-kVA capacity each for Messrs. Dorman Long (Middlesbrough).

A 5,000-kVA, 22,000/500-V, 50-cycle, three-phase outdoor transformer recently supplied to the C.E.B. for installation at the thread mills at Paisley of Messrs. J. & P. Coates, is fitted with detachable radiators and on-load tap-changing gear for from + 3 per cent. to − 10 per cent. voltage regulation on the 22-kV side arranged to give ten 1.3 per cent. steps.

The transformer shop is well removed from the other buildings as a safeguard against the possibility of metallic dust getting into the equipment during manufacture, and its lay-out represents a really good example of modern practice. All process work, from the raw material to the despatch stages, is kept under direct control, and it was good to see how well the various operations are synchronised with the unidirectional flow of materials.

In this department in addition to the special coil-winding machines, the combined spraying equipment and travelling drying oven for the treatment of the core laminations, the vacuum and impregnating plant and the core-building equipment, there is a 500,000-V testing transformer.

A good lay-out for transformer construction

A Frequency Coupler

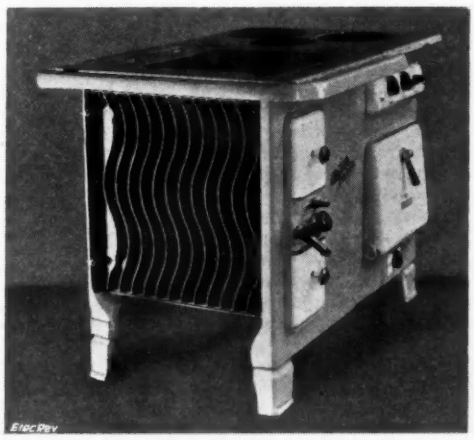
For the linking up of distribution systems in Switzerland the Brown-Boveri Co., of Baden, has a contract in hand for an induction-synchronous convertor with a Scherbius set for the Bevers sub-station of the Rhaetische Werke für Elektrizität in Thusis. The set is intended to replace a three-phase single-phase convertor with flywheel and storage battery. On the a.c. side it will be either supplied from the power stations of the Brusio Co. in Puschlav or from the Rhaetische Werke in Thusis; it works on the a.c. single-phase side in parallel with the single-phase generators of the Rhaetische Werke or the Bündner Kraftwerke in Küblis on the contact wire of the Rhaetic Railway. The set thus serves as a flexible connection between two systems, the frequencies of which fluctuate from 49.5 to 51.5 cycles and 15 to 18 cycles respectively. The convertor set is to be in continuous buffer duty. The output on the shaft of the single-phase generator, which was taken over from the old set, amounts to 1,300 kW continuous rating or 2,000 kW for five minutes. A feature of the plant is the newly designed frequency regulator to be used to govern the load transmitted as a function of the frequency on the railway line, it taking the place of the former standard turbine pendulum.

The Brown-Boveri Co. has also worked out a system which allows of flexibly coupling two three-phase systems of different frequencies by means of a single mercury rectifier. This is for application in Italy in order to couple a three-phase traction system of low frequency with industrial supply systems of the ordinary frequency.

The Paris Fair

Interesting exhibits in the electrical section

INTERNATIONAL difficulties do not seem to have affected the interest taken in this year's Paris Fair, the exhibitors at which include numerous electrical concerns. Many improvements are to be seen, manufacturers having made special efforts to produce appliances better adapted to the purpose they are intended to serve. One of the most interesting sections of the electrical display is that of the heating group, which has for the first time been included in the general electrical part of the Fair. Developments in electrical applications in industry have encouraged manufacturers to devote particular attention to this aspect. Most of the equipments exhibited are small, and among these the high-frequency furnace seems to be given preference, a considerable variety for all purposes being offered. High-temperature furnaces are also to be seen, one with silicium carbide resistances made by Wild-Barfield Electric Furnaces, Ltd., attracting a good deal of attention.



A combined coal and electric range by Arthur Martin; the side is removed to show construction

Bakers' and pastrycooks' ovens and electrical apparatus for frying have also increased in number. In all these branches an effort has been made to ensure simplicity of operation and greater efficiency. The development of electricity in the rural districts is a particularly noticeable point. This is reflected in the larger number of motors for such applications which are on view. One of the most compact and well designed units for agricultural applications is a motor and control apparatus built on to a small hand barrow. The whole set is provided with a dust-proof cover so that it can be used in the generally dust-laden atmosphere of barns.

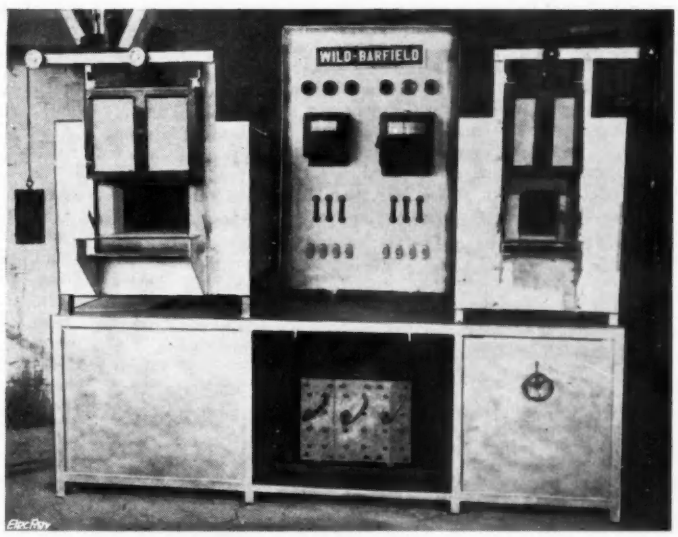
In some lines of domestic appliances rural influence is also noticeable, especially in ranges. Arthur Martin is showing a combined electric and coal range which is particularly adapted to rural areas where the farmer prefers to use coal in the winter and where the electric range is a great advantage in summer. The electrical section of the range comprises three hot-plates with a combination grill and oven below. The connected load is 5,300 W. In the more usual types of electric ranges and cookers the outstanding feature is the considerable improvement in general appearance. Every effort is being made to offer a range that is neat and easy to keep clean. Improvements of detail, as in the lagging of the ovens, are also to be noted.

Other types of domestic appliances show this same care on the part of the makers. Ease in handling is also the keynote in the vacuum-cleaner section, in which the control of motor speed and reversal of the direction have now become standardised on practically all models. Greater facility in handling is noted in some designs which are being presented in small sizes so as to be suitable for cleaning in corners and yet have a sufficient capacity for the modern small apartment.

Electrolux is exhibiting a floor waxer for apartments, in which the metal parts have been replaced by bakelite. Improvements of technical details in the new model include a higher speed for the motor and special protection to prevent the possibility of sparks setting fire to waxes with a petrol or turpentine base.

A greater number of French-built refrigerators are included in this year's Fair; a few years ago refrigeration was entirely in the hands of importers. Both the French and other models are "cleaner" in design, and it seems that attempts are being made by some manufacturers to improve the efficiency of their equipment. In this connection the new "Conservador" with a double door to avoid the constant entry of warm air into the main body of the refrigerator is noteworthy. Frigidaire also exhibits the "Frigoplate" for shops as an interesting novelty. It is intended to replace the ice on the counter for the display of foodstuffs in the open air, and is particularly adapted to a country like France, where the customer likes to see what he is getting from every angle before he decides to take it.

In the radio section simplicity and improvement in quality are also the dominating features. One or two novelties in the arrangement of the dial are to be seen, such as the new "Khalife Bagdad." This has the stations grouped in four sections, namely, French and foreign medium waves placed in the outside of a circle carrying the pointers, and long waves and short waves placed on the inside of the circle. This circle carries four pointers, one for each group of stations, and the arrangement is such that the dial takes up almost the whole of the front of the set.



A Wild-Barfield high-temperature furnace

A dish-washer by Miele is also of interest. It is provided with a motor at the bottom which operates a propeller, the action of which is to throw the hot water violently around all parts of the container. The dishes rest in two trays placed one above the other, the lower one containing the plates and the silverware and the upper one cups and glasses.

Potentialities of Electricity in Mines

THE failure of local colliery officials to appreciate the potentialities of electricity in mining was stressed by Mr. G. M. Harvey, deputy electrical inspector of mines, in the course of a lecture given at Cardiff on Saturday last to the South Wales and Monmouthshire branch of the National Association of Colliery Managers. Mr. Harvey said that during the past sixteen years the total horse-power of motors used underground had increased throughout the country as a whole by 71 per cent., and that of coal-face electrical machinery by not less than 200 per cent. In South Wales, however, the increases were only 30 and 15 per cent. respectively. During the same period the proportion of the total horse-power employed at the coal-face increased from 10 to 17.2 per cent. for Great Britain, while in South Wales it fell from 1.75 to 1.5 per cent. It was clear that South Wales did not look with favour upon the use of electricity at the coal-face in 1920, and that it had not changed its mind since then. Dealing with the safe use of electricity underground, Mr. Harvey stated that during the past sixteen years there had been twenty-three explosions of fire-damp due to electricity and resulting in fatalities. Though this was a small number, it should be further reduced as a result of the improved design of flameproof electrical apparatus. The secret of immunity from explosions was efficient maintenance of the plant. Such maintenance demanded the employment of trained and conscientious electricians and, furthermore, it was necessary that there should be proper discipline on the part of those handling the apparatus.

Storage Heater Losses.

By E. W. Golding, M.Sc.(Tech.), A.M.I.E.E.

THERMOSTATICALLY controlled heaters of either the displacement or pressure type of comparatively small loadings have the disadvantage of a lengthy recovery period after withdrawal of a tankful of hot water. External and immersion circulators enable a small quantity of hot water to be obtained quickly and, when controlled by three-heat switches with or without a thermostat, may reduce energy consumption if used with discretion.

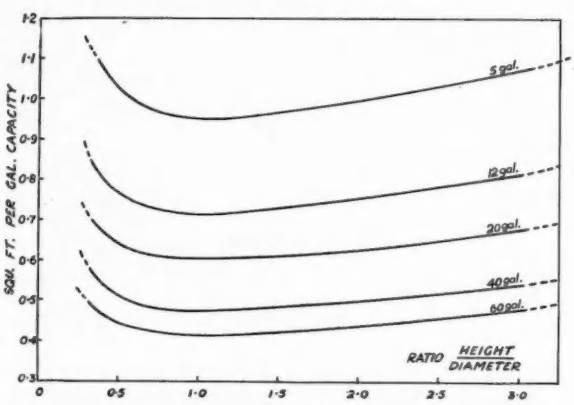
Tank radiation losses must largely affect heating costs with all types of storage heaters although a complication arises in the case of an immersion heater used in conjunction with a fuel-heated system when the radiation from the tank is employed for airing purposes in the linen cupboard enclosing the tank. In such cases efficient lagging to reduce radiation losses may be undesirable.

For a given temperature difference between the hot water and the surrounding air the heat losses depend directly upon the surface of the tank as well as upon its lagging. The minimum surface for a given volume is, therefore, important in connection with reducing the stand-by losses to the lowest possible value so that storage heating may be economical.

In this discussion the dimensions refer to the hot-water tank itself, *i.e.*, under the lagging. The fact that the upper surface is often domed is neglected, and the tank is assumed to be completely filled with water. Neither of these assumptions is sufficiently removed from practice to invalidate the calculations. If R ft. be the radius of the tank and H ft. its height, then its volume is $\pi R^2 H$ cu. ft. and its surface area is $2\pi R(H+R)$ sq. ft. Therefore, the surface area per cu. ft. of volume of tank per gal. is the minimum when R=H/2, *i.e.*, when the height of the cylinder is equal to its diameter. In practice, however, a cylinder of these relative dimensions is not convenient in most situations since, especially in the larger sizes, it would project too far from the surface or wall against which it is fitted.

The curves representing the surface area of tank per gal. capacity plotted against different ratios of height to diameter for tanks of five standard sizes show the minimum in each case to be when the ratio of height to diameter is unity.

It is important to note, however, that the curves are very flat from this point upward, so that the surface per gal. is not greatly increased up to a ratio of 2 or 2.5, although the curves rise more sharply for ratios less than unity. In the case of most tanks of the displacement-type heaters on the market the ratio of height to diameter is about 2 to 2.5. Another important point is the very considerable reduction in surface per gal. as the tank capacity increases. In the curves, this falls from 0.95 sq. ft. in the case of a 5-gal. tank to 0.41 sq. ft. for a 60-gal. tank. An increased efficiency may therefore be expected from a large tank if the hot-water requirements are great enough to justify its use.



Surface area of tank per gal. capacity plotted against different ratios of height to diameter of five standard-size tanks

Heat Losses and Efficiency

In attempting to estimate the heat losses from tanks in general a difficulty arises owing to the very great differences between those with efficient lagging, as in manufactured heaters, and those without lagging, or with lagging applied to the tanks after installation and usually, therefore, much less efficient than in the manufactured heaters.

These losses are more conveniently expressed in watts than in B.th.u. per hour or per minute. A figure of 0.04 W per sq. ft. per deg. F. temperature difference has been given for

Dependence of efficiency upon the relative dimensions

heaters lagged during manufacture, but in determining this figure the surface is measured over the whole of the finished heater, *i.e.*, over the lagging. For general purposes it would seem more useful to express the loss in terms of the surface of the tank itself, *i.e.*, under the lagging. Taking into account the usual amount of lagging in such heaters the figure in terms of the actual tank surface may be taken without much error as about 0.065 W per sq. ft. per deg. F. With a hot-water temperature of 170 to 180 deg. F. there is thus a loss of about 8 W per sq. ft. of tank surface in this case.

For heaters with fairly efficient strip lagging after installation this figure must be increased to from 12 to 15 W per sq. ft., the loss rising as the lagging is reduced until it is of the order of 70 or 80 W per sq. ft. for an unlagged tank.

From these figures it is easy to appreciate the importance of lagging if economical operation is to be achieved. On the other hand, it is possible to reduce the losses considerably for the same degree of lagging if the method of heating, by circulator or otherwise, is such that over long periods the water in the upper portion of the tank only is fully heated. After completely emptying the tank the average loss during the recovery period will be about half those quoted above, since they will correspond to a temperature half-way between the cold and hot temperatures of the water.

Table I gives the maximum losses (corresponding to the full hot-water temperature) for the five sizes of tanks considered above, the surfaces per gallon being taken from the curves on the assumption that the tanks concerned have relative dimensions not greatly differing from those corresponding to the minimum surface per unit volume.

TABLE I.—RADIATION LOSSES.

Capacity of tank (gal.).	Loading in W.	Minimum surface (sq. ft. per gal.).	Minimum surface (sq. ft.).	Loss in W.	Loss in kWh per day.	Efficiency per cent.
5	500	0.95	4.75	38	0.91	92.3
12	1,000	0.715	8.57	68.5	1.65	93.1
20	2,000	0.60	12.0	96	2.3	95
40	3,000	0.475	19.0	152	3.65	95
60	4,000	0.415	24.9	199	4.78	95

The efficiencies tabulated in the last column of Table I were calculated on what is necessarily a somewhat artificial assumption, namely, that the hot-water is drawn off at exactly the rate at which it is produced by the net wattage available for heating. For example, only 462 W is available in the first case, the remaining 38 W supplying the losses. Under these conditions the temperature of the whole of the water in the tank will be the full hot temperature. Admittedly, this represents a very uneconomical state of affairs, but it is perhaps useful to realise what the position may be in such an extreme case of maximum losses. The rates of withdrawal of hot water (allowing 130 deg. F. temperature rise from cold) on this assumption are according to Table II.

TABLE II.—RATES OF HOT WATER WITHDRAWAL.

Tank capacity (gal.).	5	12	20	40	60
Withdrawal in gal. per hr. ...	1.21	2.44	4.98	7.47	10

In practice, water would never be withdrawn continuously. According as the rates of withdrawal are less or greater than the above, so will the efficiencies be less or greater than those quoted.

Rectangular Tanks

As compared with the cylindrical form, rectangular tanks have the advantage that their relative dimensions may be changed more easily to suit the accommodation available. The fact that there are now three variables as against only two in the cylindrical case makes the rules regarding surface area per unit volume slightly more complicated.

If the width of the tank be B ft., its depth D ft. and height H ft., then the volume of the tank is B D H and its surface $2(HB+HD+BD)$. Therefore, the surface per gal. is the minimum when B=D=H, *i.e.*, when the tank is cubical. This form may not, however, be suitable in all situations, a shape of such relative dimensions as H:B:D=3:2:1 being more convenient.

Comparing the two forms of tank we have (*a*) cylindrical minimum surface when H=2R, giving a volume of $2\pi R^3$ and a surface of $6\pi R^2$; (*b*) rectangular minimum surface when B=D=H, giving a volume of H^3 and a surface of $6H^2$. A comparison of the surfaces for an equal volume in each case shows

(*Concluded at foot of next page.*)

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

The All-electric Bungalow

Much has been said about the all-electric and nearly-all-electric house. Here are some details about an *entirely* electric bungalow, having six rooms and accommodating a family of three, which may interest your readers.

The price of electricity is ¾d. per kWh (except for water heating) with a fixed charge of 12s. 6d. per quarter. I have an electric cooker, kettle and stewpans, all obtained from the supply authority for a few shillings per quarter, and maintained for eight years. This equipment gives perfect cooking for an average consumption of 1 kWh per day per person.

An electric wash boiler does the week's washing in about 1½ hours for the consumption of 4 kWh. The latest addition to the family, and one of the most welcome, is an electric refrigerator. For the small sum of 2s. 6d. per week it not only keeps our food fresh and clean, but enables us to have many dishes which previously we could not afford, and all for a unit per day.

A large amount of special lighting was provided in the "Queen Mary" by the British Thomson-Houston Co. Our picture shows the mail hall with its large central fitting, said to be the largest individual lighting unit in the ship

An immersion heater fitted into the existing hot-water tank is on hire, and electricity for this purpose is supplied at a special rate of ½d. per kWh. The heater is entirely automatic and a really hot bath can be obtained for about 2d.

As regards the other rooms, all fires are electric and they consume from one to two kWh per hour. The cleaning of carpets, &c., is carried out by the vacuum cleaner at an infinitesimal cost, the amusement is provided by an all-electric wireless set, and an iron taking ½ kWh per hour is always available. The lighting, although not very decorative, is good, and for the heaviest quarter the consumption was only 42 kWh.

The account for the last quarter which is the largest one of the year was well below an average of 10s. per week, and as there were no outgoings on coal or gas I doubt if any other method can give such wonderful service for so small an expenditure.

J. S. LEE.

Upminster, Essex, *May 25th.*

Storage Heater Losses (*Continued from preceding page*)

that the minimum surface of a rectangular tank is 8½ per cent. greater than that of a cylindrical tank of the same volume.

The following general rules regarding the best relative dimensions of H, B and D may be laid down. Suppose the ratio H to B is fixed at a. Then in order that the surface per unit volume may be the minimum under these conditions, the ratio H to D must have the value $1+a/2$. For example, if H is to be twice B, then $a=2$ and the ratio H/D must equal $(1+2)/2=3/2$ if the surface is to be the minimum. Again, it can be shown that the surface per unit volume, when the relative dimensions comply with the above rule, is $3(1+a)/H$ sq. ft. per cu. ft., or $3/6\frac{1}{4}\ (1+a)/H$ sq. ft. per gal.

If G is the capacity of the tank in gallons, and if the relative dimensions are made to give minimum surface as laid down above, the necessary magnitude of H is $\sqrt[3]{\frac{Ga(1+a)}{12{\cdot}5}}$.

For example, with a 20-gal. tank and the ratio H/B at the outset made equal to 2, the best value for H/D is then 1.5. The actual value of H is $\sqrt[3]{\frac{20\times2(1+2)}{12{\cdot}5}}=2{\cdot}125$ ft.

giving B=1.062 ft. and D=1.42 ft. The surface per gal. is then $3/6\frac{1}{4}\ (1+2)/2.125=0.677$ sq. ft.

It must be realised that the surface per gallon obtained as indicated will always be greater than the true minimum corresponding to a cubical tank, but will be the least value obtainable after the ratio H/B has been fixed.

Fair Trading Policy

The reference in your issue last week to Committee "D" prompts me to remind you of the origin and function of that Committee.

Subsequent to the setting up of the Statutory Committee in accordance with Section 48 of the Electricity Act of 1926, there were naturally various matters requiring investigation and committees were appointed for this work, and these were described as Committee A, Committee B, and Committee C.

It was brought to the notice of the Statutory Committee that the E.C.A. of Scotland was discussing with suppliers conditions of trading, and as this appeared to be allied to the work of the Statutory Committee it was decided by that Committee to set up another committee to report upon the Scottish proposals and following alphabetical sequence, this further committee was designated as Committee "D."

The I.M.E.A. was represented on Committee "D" but not the electricity supply companies, as they were not concerned with Section 48 of the 1926 Act nor were they represented on the Statutory Committee.

Committee "D" only came to an end after its report had been completed and handed to the various bodies represented on the Committee for their consideration and further action if thought desirable. Further action needed an organisation and funds to carry on the work, and for this Committee "D" had no authority. The majority of the bodies decided on further action and set up the Fair Trading Council, which has now issued the authoritative document based on the report of Committee "D."

Knowing the work involved, I must pay tribute to the time and patience of the Council in producing the detailed policy and the reasonable and common sense proposals contained therein. Why should anyone oppose "Fair trading"?

London, W.C.2, *May 26th.* F. W. PURSE.

[Mr. Purse was chairman of Committee "D."—EDS., ELEC. REV.]

Institution Membership

The small number of transfers from associate to full membership given in your issue for May 8th surely indicates that there is something seriously amiss with Institution promotion systems generally. The "Electricals" are not by any means alone in this respect, as other leading Institutions appear to suffer from the same malady, but this does not mitigate the evil.

Apparently it is quite a straightforward matter to obtain transfer if the applicant has had the good fortune, as good fortune it surely is nowadays, to work himself up into a rather good position, but if not he appears to stand little chance. Surely if an associate member has worked steadfastly at his profession and reached the age of, say, forty to forty-five, he can reasonably be supposed to have expanded his knowledge and experience in one way or another so as to warrant this recognition.

As it is, it is my experience that full membership of the leading Institutions is falling into disrepute due to its becoming associated with out-of-dateness and advancing years. It is not difficult in fact to find men who have led a hard-working and worthy life, the end of which is almost in sight, without being privileged to drop the letter "A." From this it would appear that the lower grade is not being encouraged to apply, or is being turned down, as one cannot help but notice the many able men still attaching the letter "A." This is not to the interests of the Institutions generally, and if persisted in will detract from the value of corporate membership.

May 24th. SINE OF AN ARC.

A Transparent Moulded Material

THE Imperial Chemical Industries new transparent synthetic resin "Diakon" has already been used for such articles as battery boxes and vents, coil formers, telephone sets, fuse-box covers, relays, terminal boxes, switchgear, lighting fittings, machine inspection covers and radio cabinets, and it seems likely to find many other applications in the electrical industry. Fundamentally, it is the same substance as "Perspex," the two names being given to the granular (for moulding) and sheet or cast forms, respectively. "Diakon" has a low power loss and as an insulator is stated to be surpassed by only one other plastic material.

The transparent "Diakon" cabinet of this G.E.C. demonstration model radio receiver enables prospective customers to see the method of interior construction

Its great mechanical strength and light weight, the ease with which it can be worked, its stability and low water absorption render it applicable to many electrical purposes. It is equally suitable for compression or injection moulding, and the mouldings may be turned, milled, cut, bored, ground, bent and polished in exactly the same way as soft metal. The moulding processes are the same as those for other plastic materials, the maximum temperatures and pressures required for compression moulding being respectively 150 deg. C. and 2 tons per sq. in., and for injection moulding 170 deg. C. and 5 tons per sq. in. Pieces of "Diakon" may be cemented together so that no joint is visible.

Battery manufacturers should be particularly interested in the new thermoplastic, since it is half the weight of glass yet stronger, and it has better acid-resisting properties than existing plastics. Freedom from excessive inflammability is another point in its favour; it burns but slowly and the fire can be easily extinguished. Its transparency permits inspection of the plates, and it will not warp or crack. Salt water, alkalis, lubricating oils, greases, and transformer oils have no effect on the material.

In its opaque form "Diakon" is suitable for the manufacture of coloured telephones. Unlike many other plastics it does not fail in dry atmospheres, nor does it become weakened at the points where it is moulded round metal. Numbers of moulded "Diakon" telephones installed abroad have proved satisfactory.

In addition to the more obvious uses mentioned, the material has considerable possibilities in showrooms for demonstrating the interior construction of products. An interesting example of this is the radio cabinet illustrated, which is standard in every way but transparent.

Below are given details of the physical, mechanical and electrical properties of "Diakon."

PHYSICAL PROPERTIES OF MOULDED "DIAKON"	
Specific gravity	1.19
Water absorption (7 days)	0.22%
Shrinkage	0.0035 in. per in.
Heat resistance (Martens test)	50° C.
Thermal conductivity kg. cal./ft.²/inch/°C/hour	0.57
MECHANICAL PROPERTIES	
Tensile strength	3.5 tons per sq. in.
Impact strength (B.S.S. cut notch)	3.0 Kg. cm.
Ultimate fibre stress in bend	5.0 tons per sq. in.
Compression strength:	Flows at over 5 tons per sq. in.
ELECTRICAL PROPERTIES	
at 20° C. and 75% humidity	
Surface resistivity	$>10^{16}$ megohms.
Volume resistivity	$>10^{8}$ megohm cm.
Breakdown voltage	480 volts/mil for specimens 0.040 in. thick.
Permittivity	
at 5 × 10^7 cycles	2.6
10^6	2.9
800	3.6
50	4.0
Power-factor	
at 5 × 10^7 cycles	0.022
10^6	0.019
800	0.033
50	0.038

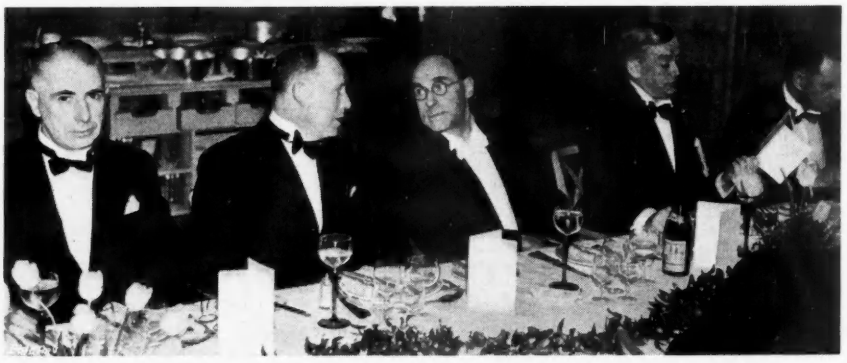
A Laboratory Rectifier

TO facilitate the study of rectification in schools and colleges a special unit has been designed by the Westinghouse Brake & Signal Co., Ltd. The outfit is entirely self-contained and all connections are brought out to large terminals on the front panel, clearly marked to indicate their functions. There are six separate half-wave metal rectifiers, each connected to two marked terminals on the front panel, and rated at a maximum output of 1 A at 35 V, when used in a three-phase full-wave circuit. There are three transformers, each having a primary winding tapped for 200/230/250 V, 50 cycles, and each secondary providing 0.9 A a.c. at 32 V r.m.s. Six ammeters and voltmeters are included and the complete set is contained within a metal case measuring externally 14.25 in. wide, 7.5 in. deep and 22 in. high, arranged for bench mounting. Apart from its school demonstration utility, the outfit should be specially convenient in general laboratory work where circuits need to be continually rearranged. The experimenter has complete freedom in grouping the units for a variety of circuits, since each has its own terminals and is electrically independent, though capable of functioning together as an assembly. The general lines upon which a fruitful series of experiments may be carried out are suggested in a booklet compiled by the company, which is well illustrated with circuit diagrams, characteristic curves and voltage wave-form oscillograms.

"Old Cromptonians"

THE annual dinner of the Association of "Old Cromptonians" was held at the Mayfair Hotel, London, on May 22nd, over a hundred members being present. Col. Crompton, whose birthday is on Whit Sunday, when he will enter his 92nd year, was in the chair.

The Colonel's health was proposed by Sir Charles H. Bressey, C.B., C.B.E. Col. Crompton, speaking easily and without any notes, said that to a man as old as he was the liking and friendship of those with whom he had worked all his life was of all things the one most worth having.



At the "Old Cromptonians" dinner: Left to right—Mr. W. Garrett (general manager, A. & T. Burt, Ltd., N.Z.), Mr. E. C. Holroyde (director, Crompton Parkinson, Ltd.), Lt.-Col. K. Edgcumbe (chairman, Everett, Edgcumbe & Co., Ltd.), Mr. Frank Parkinson (chairman, Crompton Parkinson, Ltd.), and Sir Charles Bressey

Sir James Swinburne, Bt., F.R.S., whose association with Crompton's dates back to the 'eighties of the last century when he was designer and technical manager at the Chelmsford works, proposed the toast of Crompton Parkinson, Ltd. In his reply, Mr. Frank Parkinson said something of the tasks which had been set when the company was reconstructed nine years ago, and the progress which had been made towards the achievement of their objects, which were to make the financial position of the company absolutely secure, to establish its reputation throughout the world, and to cultivate a good relationship between the management and every employé. After Mr. E. J. Fox, the chairman of the committee of the Association, had dealt with some formal business, and Col. Crompton had proposed the health of Mr. Albert Parkinson, the company dispersed.

Switching and Convenience

A booklet of 32 pp. is to be issued on June 1st by Messrs. J. A. Crabtree & Co., Ltd., at 6d., on "Tumbler-Switch Wiring and Applications." No. 1 of "Modern Electric Practice" series is intended to serve as a handbook for those engaged in the application of convenience switching. Diagrams are given for every recognised method of wiring, including series-parallel, master-control, and two-way, with instructions regarding what to do and in some cases of what not to do to secure a safe and satisfactory installation.

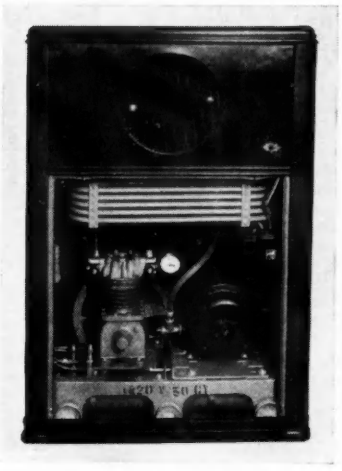
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Air Conditioning

A self-contained unit for cooling, humidifying and circulating air has been introduced into this country by AIR CONDITIONING, LTD., 4/12, Palmer Street, Westminster, London, S.W.1.

Known as the "Ilg Spot Cooler," this apparatus works on the same principle as an ordinary refrigerator. A compressor is situated in the bottom of the cabinet and a fan and cooling coil in the top, the liquid refrigerant being circulated through the cooling coil, which corresponds to the freezing unit in a refrigerator. The room air is cooled by being drawn through this coil by a fan, while much of the moisture condenses out of the air and is carried away with the water used to cool the compressor. The circular grille permits concentration of air flow in any direction.



The "Ilg Spot Cooler" for air conditioning

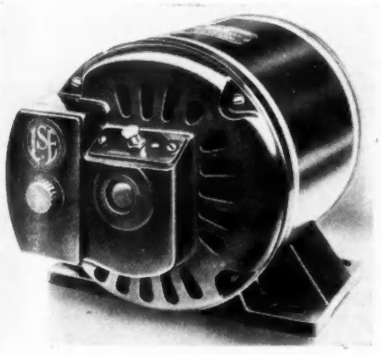
The unit is controlled by a switch which opens the solenoid water valve, allowing water to flow through the system to operate the pressure water switch which starts the motors. A thermal cut-out is also incorporated. The water inlet is fitted with a removable strainer. The compressor motor is water-cooled by a cored jacket, water passing through this jacket after leaving the condenser. A small float switch is fitted to the drain pan which, in the event of the pan overflowing, will interrupt the water valve circuit, so stopping the machine.

The normal consumption of water is ¾ gal. per min. and the electrical loading 600 W. For the refrigerant 6 lb. of "Freon" is used.

The cabinet is finished in grained walnut and measures 42¾ in. high by 29¼ in. wide, and 18½ in. deep, and, with its circular air outlet, much resembles a console radio set; a ceiling unit is also available.

A Capacitor-induction Motor Without Brushgear

The "Red Band" fractional horse-power motor of the capacitor-induction type made by Messrs. LAURENCE, SCOTT AND ELECTROMOTORS, LTD., Australia House, Strand, W.C.2, has been redesigned with a view to obviating the complications of starting gear on the rotor and reducing maintenance costs.



A "Red Band" fractional h.p. motor

In the improved machine the rotor is of the squirrel-cage type, free from slip-rings, and brush lifting mechanism. The starting device now takes the form of a contactor with tungsten contacts mounted accessibly in an enclosure in the end bracket. When the machine is switched on, the starting current automatically causes the contacts to close, bringing the condenser into circuit. On the current falling below a predetermined amount the contacts open, and the machine runs as an induction motor. An overload of 250 per cent. or more brings the contacts together again, the machine running as a capacitor motor until the overload is removed or the protective device operates.

The absence of auxiliary mechanism on the rotor reduces the possibility of maintenance being required during service, an important feature in a small machine; further, by eliminating all rubbing contacts radio interference has been overcome. The smaller "Red Band" machines are capable of starting against as much as 600 per cent. full-load torque. The retention of the self-contained condenser reduces the space required and preserves the symmetrical appearance of the machine. The condenser is contained within the barrel of the motor and is of the self-sealing type. If a breakdown should occur, the electrolyte will automatically seal a puncture. The standard motor has sleeve bearings and diamond-bored bushes. Provision is made for silencing end-knock, and all motors are dynamically balanced. Ball bearings can be provided when required.

A complete range from ¼ h.p. upwards is listed, in horizontal, vertical flange and geared types.

Weatherproof Floodlights

Next year's Coronation should bring with it a big revival of interest in floodlighting, so that the introduction of the new "Pentland" projector by ECA-RAY SALES, LTD., 3 and 7, Sandland Street, High Holborn, London, W.C.1, comes at a very opportune moment.

The "Pentland" floodlight projector

The fitting, which is claimed to be completely weatherproof, incorporates a "Penton" silver-glass reflector having 108 facets moulded in four tiers, and giving a 60 ft. wide beam at 20 ft. It is intended for 500 to 1,000-W lamps, and is fitted with the latest type of focusing device. The front glass, which is 14 in. in diameter with a 2 in. bulge, can be supplied either plain or sand-blasted. Swivel brackets enable it to be adjusted to any position. The body of the new projector is stoutly constructed of spun brass.

The same company is also marketing the new "Raitt's" tubular chain for suspending lighting pendants. The flex is practically concealed by the solid drawn tube, which is made in both round and square patterns, and links may be readily added or removed.

Interlocked Plug-and-Switch Units

A completely interlocked 5/10-A double-pole plug and switch unit is the latest development by MESSRS. A. REYROLLE & CO., LTD., Hebburn.

It comprises a d.p. tumbler switch and a 5/10-A plug and socket of the "Easigo" two-pole and scraping earth type. The parts are mounted in a metal case and so interlocked that the switch cannot be closed unless the plug is in full engagement with the socket; neither can the plug be withdrawn when the switch is closed.

The Reyrolle interlocked plug and switch unit with (top) an insulated protected-type plug with fuses incorporated, and (below) a metal-clad protected-type plug

The switch is actuated by a short rotary movement of the ring-shaped operating device mounted on the case concentrically with the socket and provided with fringed grips. Two plugs are obtainable, one an insulated protected type with self-contained fuse and the other metal clad. The earthing terminal is suitable for internal or external connection, and a boss is provided for taking screwed conduit up to 1 in. The entry may be either at the top or bottom.

Small Motors

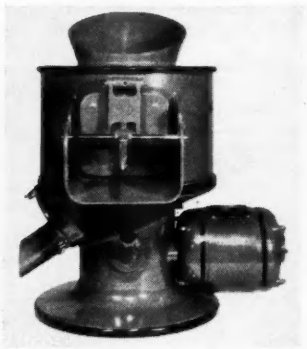
A recently introduced "Batwin" motor is the "G.P.," a ¼ h.p. split-phase machine with a starting torque twice that of full load, and taking five or six times full load current, the running rating being 2.5 A at 220 V, 1,425 r.p.m.

The motor is designed for continuous duty, the temperature rise being 40 deg. C., and the bearings are of extra heavy bronze, grooved and drilled to provide free circulation of the lubricant.

D

An Electric Potato-peeling Machine

Designed for standing on a bench or table, a compact little machine marketed by the PEERLESS ELECTRICAL MANUFACTURING CO., LTD., Stanhope House, 320-324, Euston Road, London, N.W.1, will wash and peel potatoes at the rate of 10 lb. per minute with a reduction in wastage of 50 per cent.



The Peerless "VP-10" potato peeler

Carrots and turnips can be prepared for use, and the machine can even be used for topping and tailing gooseberries. Model VP-10, the machine illustrated, is suitable for kitchens serving from 35 to 350 meals and larger types are available with capacities of 14, 28 and 56 lb.

The machine measures 1 ft. 10 in. high, 2 ft. 1 in. long and 13½ in. wide, and weighs 146 lb. Its ¼ b.h.p. motor is of the totally enclosed type, with automatic lubrication.

Rectifiers for Radio Purposes

For the operation of d.c. radio receivers on a.c. mains MESSRS. HOLIDAY & HEMMERDINGER, Holmer Works, Dolefield, Bridge Street, Manchester, 3, are supplying a range of rectifier units. Each comprises a mains transformer, two rectifying valves, a smoothing choke and dry electrolytic condensers mounted on a metal base plate and shrouded by a cover with perforated metal sides. This type of unit has been used by Edmundsons Electricity Corporation in connection with the change-over to a.c. at Glossop.

Grinding and Polishing Equipment

Grinding and polishing machines have been introduced by the NORMAND ELECTRICAL CO., LTD., 3, North Side, Clapham Common, London, S.W.4. For grinding they are made with two 8 in. by 1 in. wheels driven by a ¾ h.p. motor, or, alternatively, two 6 in. by 1 in. wheels driven by a ½ h.p. motor. The same remarks apply to the polishing machine, except that two mops on long spindles are substituted for the wheels. Combined machines are available with one mop and one wheel.

A "Neco" grinder mounted on a pedestal

Totally enclosed repulsion-start induction motors are fitted, except on the d.c. model, which is equipped with a compound-wound motor. For three-phase supplies squirrel-cage machines are provided. Switching is direct on the mains by means of an ironclad rotary switch mounted on the motor. Ball bearings are used for the shafts and the rotating parts are dynamically balanced, the motors running at 2,800 r.p.m. Home Office guards are incorporated, and the fully adjustable tool rests allow either the edge or the side of the tool to be used.

Copper Conduits

A new copper conduit system for electric wiring, for which are claimed more certain mechanical and electrical continuity combined with cheapness of installation, is announced by I.C.I. METALS, LTD., Kynoch Works, Witton, Birmingham, 6. This "Broduit" system (Broughton Copper Co.) consists of the adaptation of copper conduits of the requisite thickness and bore to standard malleable iron fittings, using screwed copper adaptors for connecting the conduit to the boxes. The actual jointing of the conduit is effected by sweating the lengths together with a simple copper coupling. An alternative is a patented all-copper conduit system incorporating copper junction and switch boxes.

Absence of corrosion risks is particularly important during and immediately following the construction of a building when it is drying out and conduits may be wholly or partially filled with water. Weights per 100 ft. for equivalent sizes of "Broduit" and heavy gauge steel conduit demonstrate the very much lower weights involved when copper is used.

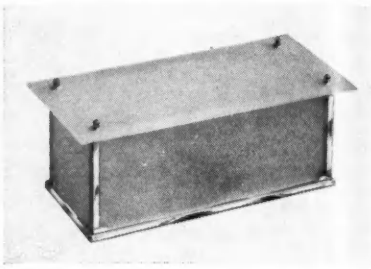
It is claimed that in the event of a fault having to be cleared the current capacity of "Broduit" copper conduit is not less than 50 per cent. greater than that of steel, while the electrical resistance of the solder "Broduit" joint is about 55 per cent. of that of the plain length of copper tube.

A booklet issued by the company gives full details of installation procedure, with clear sketches showing the method of connection to fittings. Copper is much easier to bend than steel, while no screwing of the copper tube is necessary. Prices are at present lower than those of solid-drawn galvanised or sherardised conduit, and the adoption of the new copper conduit wiring system is stated to effect a saving of from twenty to thirty per cent. in the total cost of labour for wiring.

Lighting Fittings in Cartons

A range of low-priced ceiling, pendant and wall bracket lighting fittings, each model of which packs flat in a carton only 1¼ in. thick, has recently been introduced by the EUSTON MANUFACTURING CO., LTD., 143b, Euston Road, London, N.W.1.

The method of construction of these "Castle" fittings, as they are called, makes assembly a matter of a few moments, each carton bearing an illustration and the simple instructions necessary.



One of the "Castle" ceiling fittings

All metalwork is nickel plated and the standard range of colours for the frosted glassware includes orange, gold, crimson, green, pink and blue. For a slightly extra charge several of the wall-brackets can be supplied by the company with figured glass front panels.

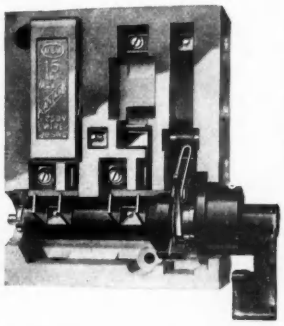
Another Oscilloscope

A cathode-ray oscilloscope is now being marketed by R.C.A. PHOTOPHONE, LTD., Electra House, Victoria Embankment, London, W.C.2, in a case with a carrying handle and weighing 35 lb. All the control knobs are on the front of the case and a special circuit with adjustable control on the front panel provides a means of accurately focusing the light beam on the screen.

The illumination intensity is such that photographs may be easily made with ordinary commercial equipment; no hood is required. The sensitivity is guaranteed at two volts per inch and a linear saw-tooth oscillator, adjustable from 20 to 15,000 cycles, is provided. A special circuit provides a positive means for synchronising this oscillator with the voltage under test. Terminals are provided so that an external synchronising voltage also may be used.

Two wide frequency range amplifiers are provided, one for horizontal and one for vertical deflection. The amplifiers are linear from 20 cycles to 90 kilocycles ±10 per cent. The gain is approximately 40. There are screwdriver adjustments at the rear of the case for both vertical and horizontal beam centring. Six valves are employed for complete a.c. operation at from 110-250 V, the total loading of the instrument being 50 W.

All-insulated Switch-fuses



The 30-A "Memroy" all-insulated switch-fuse

The 15 A "Memroy" all-insulated switch-fuse recently introduced by the MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham, 5, has proved so successful that the company has decided to manufacture another combination of the same design, but rated at 30 A.

A special feature of this design, apart from the bakelite housing, is an interlock which prevents the cover being removed when the switch is "on" or the switch being operated when the cover has been removed. Cables may be introduced at the top, bottom or back.

The cover is provided with a captive nut suitable for sealing, and all live terminals are deeply recessed but readily accessible for wiring. The overall dimensions are 6½ in. by 5½ in. by 3½ in. and the weight is 4 lb. The fuses are of the company's usual pattern.

All-wave Aerial Kit

The latest development by MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester, 6, is an "Overseas" all-wave aerial kit designed to provide noise-free reception on 15 to 550 m., a special tapping on the receiver coupling unit also allowing for maximum signal strength from long-wave stations.

Attractive Commercial Tariffs.

By F. R. Jervis, B.Com.

Encouraging greater consumption among shopkeepers

A COMMON classification of customers is under three headings, namely, domestic, commercial and industrial. The electricity supply industry is devoting a great deal of attention to increasing the load of domestic consumers, and is achieving equal success in persuading manufacturers to change over from a private supply to one from the public mains. There is, however, a vast intermediate range, that of shops of all kinds, and small manufacturing establishments, which do not seem to be receiving much special consideration.

The domestic load is one in which there is strong competition to acquire the business, and electricity tariffs, on a two-part rate, offer progressive reductions in the average price, so as to obtain a hold on the market. For large industrial use, the chief competitor is generally solid fuel, and the tariffs are not on the same basis as are domestic tariffs. There is an element of a special price in fixing industrial tariffs, particularly where a large works is converted to a public supply. There is a tendency for these tariffs to be fixed, where possible, at a price which will compete with solid fuel, *i.e.*, the tariff partakes more of a special bargain than of a scientific rate.

Commercial users, on the other hand, are dependent almost entirely on the public supply of electricity. In most cases, lighting only is required and there is no substitute for electric light in shops, departmental stores, &c. It is a common experience in the United States that the domestic and industrial classes give the least return, while the commercial rates contribute the largest sums to the profits of the companies. If that is equally true in this country there is a case to be made for a reduction in commercial rates.

The usual form of commercial rate in this country is one in which there is a fixed charge which varies with the size of the installation, plus a running charge which is often the same as that under the domestic tariff. A typical form of tariff would be £x per annum per kilowatt of maximum demand plus ½d. per kWh. There are a number of variants of this form of tariff, but the underlying idea is the same in each case.

At first sight this appears to be a fair and equitable form of tariff, similar to the domestic two-part rate which has been so successful in obtaining new business. But this rate is not so equitable between different classes of commercial users as it appears

Two, or Three, Parts?

The virtues of the two-part tariff have been so stressed in electricity supply circles that many people believe that it is one which strictly follows costs of production, *i.e.*, a consumer who purchases electricity on a two-part tariff rate is paying for what he uses, no more and no less. The fixed charge recoups the undertaking for capital expenditure and other "overhead costs," while the running costs are paid for by the unit rate. In the domestic tariff this is fairly true, because of the similarity of demands of different consumers.

Yet it must not be forgotten that electrical costs are really divided into three parts, not two: the division is into customer costs, demand costs and running costs. In the domestic tariff the customer and demand costs are combined, and charged to the consumers in proportion to rateable value, floor area, number of rooms, &c. The fixed charge is usually graded upwards so as to take care of the customer cost, *i.e.*, the lowest price which is payable under the domestic tariff may be 10s., while other consumers will find their charges graded upwards from this figure. The 10s. includes the customer cost and the demand cost. The minimum charge provision is inserted to take care of the customer cost, and as such it is a perfectly equitable clause.

In the United States it has been found that the customer cost to the electricity company is at least $1 per consumer per month. There have been many investigations into electricity costs, and the usual allocation there for cost-finding purposes is on a three-part basis. The figures which have been arrived at, as the share per customer, is from $1 up to about $1.5 dollars. Caution is needed in translating this figure into English currency owing to the practice of monthly billing, as well as to the higher wages costs in America, but a very conservative figure for this country would not be less than £1 per consumer per annum. When the costs of interest and depreciation of services and meters, meter reading, account computing, billing and collecting are taken into consideration, it will be seen that this estimate is not over-exaggerated.

Therefore a consumer who pays 10s. a quarter for "size of house" is really paying 5s. as his share of the customer costs, and 5s. as his proportion of the demand costs of the undertaking. A consumer who pays 15s. is paying 5s. for customer costs and 10s. for demand, and so on. Thus it will be seen that the costs per customer will be the same no matter what be the demand or the total consumption—these costs vary with the *number* of customers to be served, and the importance of the customer will not affect the cost. (To be more accurate the costs vary per meter to be read, so that a customer who has two meters incurs almost twice the cost of a customer who has one only; but this point is not particularly important.)

The customer costs will therefore be substantially the same for commercial consumers. Consequently, a commercial customer who is asked to pay £10 per annum per kW of maximum demand is really contributing £1 for his customer cost and £9 per kW. We are, therefore, justified in assuming that the demand cost is £9. However, a consumer whose demand is 2 kW will be asked to pay £20, *i.e.*, his customer cost is still £1, only but he is paying it twice over. The electricity undertaking could obviate this difficulty by making a specific charge of £1 for each meter and a demand charge of £9, but while this would be scientificially accurate there are practical objections. It is often hard enough to convince the uninitiated as to the necessity for a two-part tariff, without having superimposed the necessity for explaining a three-part rate!

"Blocked" Demand Charges

A method which will ensure that costs are charged accurately and yet that the consumer is not unduly "puzzled" is to "block" the demand charge. The tariff schedule would announce that the business rate is £10 p.a. for the first kW and reductions for subsequent kW. The form of tariff would be:—

For the first kW of m.d. = £10 p.a. per kW.
For the next 5 kW of m.d. = £9 p.a. per kW.
For the next 10 kW of m.d. = £8 15s. p.a. per kW and so on.

Besides having the virtue of accuracy this form of tariff has other points in its favour. It is easy enough to understand once the idea of a two-part tariff has been acquired by the consumer, and it grants "concessions" without complicating the accounting. It is also more accurate from a costing point of view, and while this will not influence the customer, it is a consideration which no undertaking can afford to neglect. There is the very important selling point that a consumer who increases his lighting installation will not find his charges increasing in proportion. There is always additional lighting load to be sold to progressive shopkeepers, but many of these are deterred from extending their lighting installations because of the high demand charges which they are asked to pay.

Further, it would extend the adoption of the two-part rate for business premises. While the majority of domestic consumers, even those who use electricity for lighting only, find it advantageous to be charged on the two-part tariff, the same is not true with commercial users many of whom find that it is cheaper for them to be charged on the alternative tariff. Where this is in a "blocked unit" form, the consumer with a large maximum demand is being unduly favoured at the expense of the moderate-sized user.

Finally, there is competition. Although electric lighting is nowadays almost indispensable in progressive shops, public electricity supply is not indispensable. A case occurred a few years ago where a large departmental store decided to install small gas engines and generate its own electricity rather than continue to pay excessive demand charges. It is obviously cheaper to *produce* electricity from a large central station than in small isolated self-contained plants, yet the *charges* for the former were considerably in excess of the latter, and a valuable load was lost.

In the United States it is quite usual to "block" the demand charge in the manner suggested above, and such methods must give the lighting salesman a valuable weapon in his campaign.

The method which has been outlined is not the only one, but it is one which should stimulate greater use, and lead to improved relations with a class of consumers who are not the most satisfied with their electricity bills.

German Radio Exports

The exports of the German radio industry have made progress in the first quarter of this year. They amounted to 877 tons of the value of 6.25 million Reichmarks and were 189 tons or 28 per cent. higher than in the first quarter of 1935. The deliveries to Holland, which stands at the head of the purchasing countries, slightly declined, but the exports to Sweden, Norway, Finland, Great Britain, Spain and Belgium increased.

Parliamentary News (BY OUR SPECIAL REPORTER)

A BILL by which the Gas Light & Coke Co., which supplies gas in an area stretching from Windsor to Southend and including most of the county of London north of the Thames, seeks to impose on all local authorities, when erecting working-class houses, the obligation to give the company facilities for putting in gas pipes was considered on May 21st and onwards by a Select Committee of the House of Commons. Sir John Ganzoni presided. A large number of local authorities which own electricity undertakings opposed the Bill.

Mr. Tyldesley Jones, K.C., opening the case for the company, said that it was promoting the Bill because of the growing tendency of local authorities to put up houses in which electricity was the only medium of light and heat. In a number of cases gas companies had got Acts of Parliament which provided that local authorities should not impose conditions on their tenants as to the use of gas or electricity, but that had not proved effective, and the company now asked for this further provision. If a private landlord told his tenants that they must use gas only there would be a tremendous outcry. No private landlord would dare to act in the way which local authorities with electricity undertakings were acting. All the company asked was that working class tenants of council houses should have freedom of choice.

Mr. Tyldesley Jones, K.C., leading counsel for the company, said an anonymous document had come into his hands which purported to be a memorandum on the Bill and contained a number of statements against it. If this had been circulated generally it would be a gross breach of privilege. He hoped if any member of the committee received the document he would tear it up. The Chairman said that no member of the committee had received the document. Counsel for petitioners against the Bill said they knew nothing about the document and dissociated themselves from it.

Mr. R. W. Foot, general manager of the Gas Light & Coke Co., giving evidence in support of the Bill, said that out of sixty-three members of the West Ham Corporation, which is opposing the Bill, fifty-one used gas in their own houses. In answer to a question, Mr. Wrottesley, K.C., said that sixty had electrical installations.

Cross-examined by Mr. Craig Henderson, K.C., for West Ham Corporation, Mr. Foot agreed that there were 1¼ million consumers in the company's area and their complaints only related to 1,913 houses.

Asked if the gas company's revenue in West Ham from sales of gas and rentals of apparatus had decreased by £99,405 in the five years 1927-32, Mr. Foot said that he had not got the figures before him. Nor had he figures showing that the number of electric cookers installed in West Ham had risen from 511 in 1929 to 8,350 in 1936.

Mr. Craig Henderson asked whether the gas company lighted its own premises by electricity. Mr. Foot replied that the main lighting was by gas, but they did use electricity where it was more suitable—if they want a lot of light in a small space such as a showroom window. Very intense lighting by gas involved more heat than the same amount of light from electricity.

Huddersfield Trolley Buses

The Huddersfield Corporation Bill, by which authority is sought for the conversion of the remainder of the tramway system to railless trolley working, was considered last week by a Select Committee of the House of Commons. The Bill was opposed by an omnibus company which objected to trolley vehicles being put on the Marsden route and considered that the services should be put under the control of the Traffic Commissioners.

Mr. J. H. Thorpe, K.C., for the promoters, said that since 1930 Parliament had authorised thirty-four municipalities to convert their tramways to trolley working. Huddersfield, which was the first borough to work its own tramways—it instituted horse trams in 1880—had already converted nine miles of tramways in the borough and now proposed to convert 29¾ miles inside and outside the borough. The scheme would cost £500,000 but the Corporation was satisfied that greater efficiency and increased receipts would justify the expenditure.

The Committee approved the Bill and ordered it to be reported for third reading. The chairman said that although the question of the control of trolley buses by the Traffic Commissioners would probably become of some importance, the Committee did not think that the matter had advanced far enough to warrant the insertion of a special clause in the Bill. The point would, however, be brought to the notice of the Minister of Transport.

The Trinidad Electric Co.

On May 20th Mr. Paling asked the Secretary of State for the Colonies if he had sanctioned the acquisition of the undertaking of the Trinidad Electric Co., Ltd.; if the Electricity Board Ordinance of 1935 had been passed and proclaimed in its entirety; if the Board was now in charge of and administering the concern; and, if not, what was the cause of the delay.

Mr. Thomas said that the answer to the first part of the question was in the affirmative. The Governor had been informed that His Majesty would not be advised to exercise his power of disallowance with respect to the Trinidad Electricity Board Ordinance, 1935, but that the proclamation referred to in Section 9 (2) of the Ordinance, vesting the undertaking in the Electricity Board, should not be issued without his (the Secretary's) prior approval. Delay in transferring the undertaking had been caused by legal proceedings arising out of the arbitration award.

Bills Advanced

In the House of Lords last week the Electricity Supply (Meters) Bill and the North Wales Electric Power Bill were read a third time and passed. The Great Western Railway (Ealing and Shepherd's Bush Extension) and the London and North-Eastern Railway (London Transport) Bills were read a second time.

In the House of Commons the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board Bill was read a third time and passed and the Colne Valley and Northwood Electricity Bill received its third reading.

In the Courts

THE House of Lords, consisting of the Lord Chancellor and Lords Blanesburgh, Russell of Killowen, Macmillan and Roche, on May 21st, delivered judgments dismissing appeals by the Central London Railway Co., the London Electric Railway Co., and the Metropolitan Railway Co. against a judgment of the Court of Appeal reversing a judgment of Mr. Justice Finlay in the King's Bench Division.

The question in the appeals of the Central London and London Electric Railway Companies was whether payments of interest on certain debenture stock were made out of the profits or gains brought into charge to tax in which case the companies would be entitled to retain the tax they had already deducted.

In the case of the Metropolitan Railway Co. the question was whether the payment of interest amounting to £35,292 on loans from the National Provincial Bank for the construction of Chiltern Court over Baker Street Station was also paid out of profits or gain brought into charge to tax. In that event the company would be entitled to repayment of the tax on the amount of the interest paid, the company having already paid the tax.

Mr. Justice Finlay had held that the interest was paid out of taxed funds and must be taken to have been so paid, but the Court of Appeal reversed that decision and decided the question in favour of the Crown. The House of Lords upheld the Court of Appeal's decision.

A Disputed Account

A disagreement between an electricity consumer and the Sunderland Corporation Electricity Department concerning the number of assessable rooms in a house under a two-part domestic tariff was mentioned at Sunderland Police Court last week when Norman S. Cooper, South Hylton, was ordered to pay £1 3s. 10d. for energy supplied by the Corporation.

It was explained that in September, 1935, the Corporation sent out circulars inviting consumers to change over to the "electric home" system whereby the electricity charge depended on the number of rooms in the house. Each consumer had to sign the top part of the form only and afterwards an inspector visited the premises to ascertain the number of rooms. After this was agreed upon the consumer changed over to the new system and completed the form accordingly. Cooper, however, it was stated, signed the whole form before the inspector arrived.

A dispute followed as to the number of rooms in the house. The Electricity Department said there were seven and Cooper maintained there were six, the other being only a box room. No agreement on this question had been reached. The chairman of the Bench (Sir John Storey) said it must be deemed therefore that Cooper had consumed electricity at the old rate and he made an order for £1 3s. 10d. (the difference between the old rate and new rate) to be paid to the Corporation.

Factory Act Prosecution

Messrs. Wingrove and Rogers, Ltd., makers of radio components, of Mill Lane, Old Swan, were fined £15 and 15s. costs at Liverpool on May 22nd for not having the tool of a power press in their factory securely fenced.

Mr. H. I. Nelson, for the company, said that the machine was guarded in one sense, as the usual method of operation involved the use of both hands to manipulate the levers before the press would start. Experts had now devised an efficient guard which would shortly be installed.

Alleged Libels Against an Electrical Engineer

At the Bridgend (Glam) Police Court last week Trefor David, a former member of the Bridgend U.D.C., was committed for trial on summonses charging him with publishing defamatory libels against Mr. W. Welbury, electrical engineer to the Bridgend U.D.C., and Councillor H. P. Williams, ex-chairman of the Council, to which he pleaded "Not guilty."

According to the *Western Mail*, the defendant accused Mr.

(*Continued at foot of next page.*)

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Crompton Lamp Factory in Canada

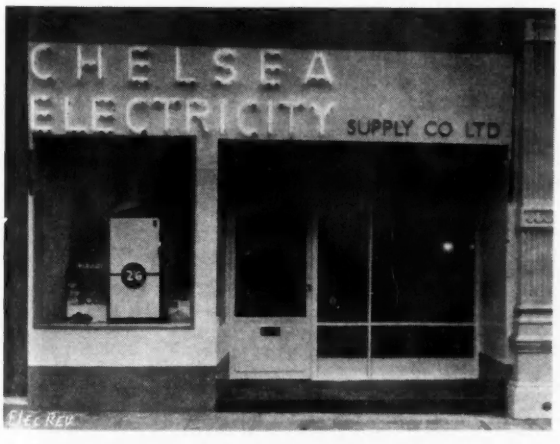
Messrs. Crompton Parkinson, Ltd., inform us that they have completed an agreement whereby a new electric lamp factory will be erected in Canada for the manufacture of "Crompton" lamps, and that in association with established Canadian interests these lamps will be marketed throughout the Dominion of Canada. The Canadian electric lamp market is one of the most important markets in the British Empire, and the company states that this will be the first time that a British lamp of Canadian manufacture has been available. At present the Canadian lamp market is dominated by American manufacturers and their Canadian associates.

E.D.A. Sales Conference

On May 20th fifty representatives of supply authorities of Yorkshire and Lincolnshire attended a one-day conference held in Leeds. At the morning session Mr. G. S. Francis, of E.D.A., spoke on "The Training of Sales Staffs in the Supply Industry," and in the afternoon Mr. J. I. Bernard (E.D.A.) addressed the conference on "Selling Electric Service for the Small Household." An interesting discussion followed each address. Mr. C. E. Allsopp, of Bradford, presided.

Chelsea's New Electricity Showrooms

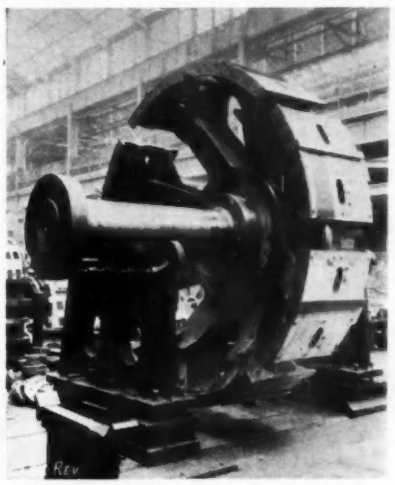
To serve the area of the Chelsea Electricity Supply Co., Ltd., the London Associated Electricity Undertakings, Ltd., last week opened new showrooms at 147, Sloane Street. As the new premises are at present intended primarily to advance the company's hire-purchase refrigerator scheme, both the window and the main portion of the showrooms, as well as the window of the Jackson Electric Stove Co., Ltd., on the opposite side of the road, contain well-thought-out displays pointing out its various attractions. Placards inform passers-by that for half-a-crown a week they can purchase a refrigerator which will "stop food wastage, protect health and reduce household expenses," and the now well-known "I'm Electric" figure appears carrying trays containing food-stuffs for the preparation or storage of which the refrigerator is particularly useful. The "Kelvinator" model offered costs only a penny a day to run, carries a five years' full guarantee, and is installed and serviced free. All down one side of the showrooms are displayed examples of electric fires, vacuum cleaners, water heaters and the smaller appliances, the remainder of the space available being utilised for clerical work. The premises are exceptionally light, and apart from a few "Bestlight" desk lamps and six reflectors over the refrigerator display, the whole of the artificial illumination is indirect and comes from four "Monolamps." Modern "streamline" plywood chairs and tables are used for furnishing. The existing arrangement of the showroom is only temporary, and it is proposed later to extend considerably the present scope, necessitating an extension of the premises.



The new premises which the London Associated Electricity Undertakings, Ltd., opened last week at 147, Sloane Street

Large Rotors for Arapuni

The rotors of the two 24,000-kVA water-wheel alternators which are being built by the Metropolitan-Vickers Electrical Co., Ltd., for Arapuni, New Zealand, are probably the largest electrical machines so far constructed by British manufacturers. On account of the powerful flywheel effect required the magnet wheel of each machine, even without its poles, is too large to be shipped in one piece. The stresses at runaway speed would be such that the rim could not easily be made in halves or quarters and the rim is therefore built up of segmental stampings of steel $\frac{1}{16}$ in. thick. They are assembled on a separate cast-iron spider with an arrangement of overlapping such as to give an effective section equivalent to three-quarters of a total section, instead of one-half obtained by simple overlapping. The stampings are clamped between end-plates, flame-cut out of rolled steel, by means of a large number of bolts passing through closely fitting holes in the stampings. The outer rim of the core is provided with T-shaped slots for "dove-tailed" fitting of the poles. The rim so built up forms a self-supporting ring. It is in no way attached to the spider, so that no centrifugal stresses due to the core and poles are applied to the spider. The rim, thus floating on the spider, is driven by means of rectangular shaped keys which allow a certain amount of expansion without the rim being able to run out of centre. The rotor is of the "umbrella" type in which the thrust bearing and the upper guide bearing are placed immediately below the magnet wheel. The rotor, complete with its shaft and exciter, weighs about 95 tons and this, together with the weight of the turbine runner and the water thrust, imposes a total weight of 220 tons on the thrust bearing. The latter consists of a rotating steel collar, highly polished, running on white-metal faced stationary segments, each of which is supported by a large number of strong steel springs to ensure uniform distribution of the load. The normal speed of the alternators is 214 r.p.m. and the rotors are being tested at a runaway speed of 85 per cent. above normal, *i.e.*, a test speed of 395 r.p.m. The stators of these machines were referred to on page 468 of our March 27th issue.



Spider wheel for the rotor of the 24,000-kVA water-wheel alternator for Arapuni, New Zealand

Bristol Engineering Manufacturers' Association

We have received a report of the progress made by the recently formed Bristol Engineering Manufacturers' Association. This Association has been formed to draw the attention of the public and buyers to the various manufactures produced by engineering firms in Bristol. The Association provides, among other things, mutual assistance to members and a co-operative scheme of publicity. The hon. general secretary is Mr. J. E. Evans, of the Ray Engineering Co., Ltd.

In the Courts *(Continued from preceding page)*

Welbury of bribery and corruption and Mr. Williams of "protecting" him. The libels were published by being carried round on a sandwich board and posted on hoardings during a council election.

Mr. J. R. Snape, prosecuting, said that David appeared to have taken a violent dislike to Mr. Welbury and had conducted a slanderous campaign against him for some years. In 1934 the defendant had a judgment made against him in a slander action and was later adjudicated a bankrupt. At that time Mr. Welbury had issued a writ for slander against him, but did not proceed as there would have been no purpose in pursuing a civil action.

Mr. Welbury, in evidence, said that there had been trouble between himself and David in connection with the supply of electricity. He strongly denied that he had been guilty of bribery or corruption.

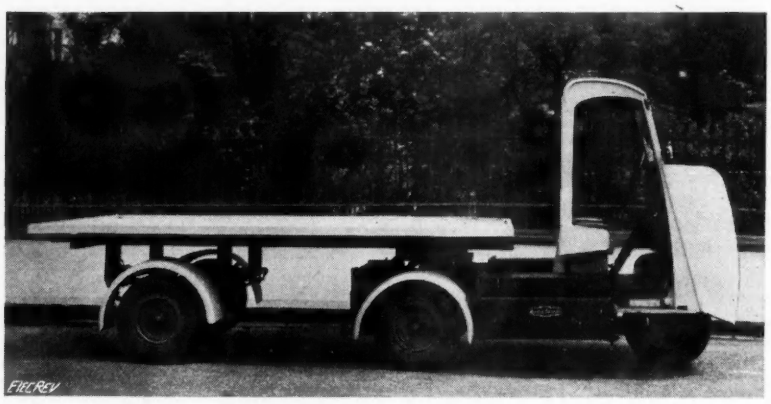
Councillor Williams, cross-examined regarding arrears alleged to be owing to the Council by David, agreed that it was possible that other members of the Council were also in arrear with their electricity accounts. He denied that £31,500 had been spent in three years among three firms without any tender. He also denied that all the coal contracts went to one firm or that an electrical contractor who was a friend of his had received an order for various goods required by the Electricity Department. Other firms had shared in the contracts in question.

The B.E.A.M.A. Annual Dinner

The annual dinner of the British Electrical and Allied Manufacturers' Association will be held at Grosvenor House, Park Lane, London, W., on Tuesday, November 17th, when the president, Lord Derby, will be in the chair.

Works Visit

The South Wales Branch of the Association of Mining Electrical Engineers held its annual meeting at Lydbrook on May 20th as the guests of the Edison Swan Electric Co., Ltd.



The Morrison electric mechanical horse and trailer demonstrated last Friday to members of the Railway Clearing House Committee

After luncheon at Speech House Hotel (Forest of Dean) the party proceeded by car to the Edison Swan cable works where Mr. F. V. Hasemore, director, welcomed the visitors who made a two-hour tour of the factory and new extensions now under construction. At tea, on the premises, the branch president, Mr. Howard Williams, expressed the thanks of the visitors to the management of the company, on behalf of whom Mr. F. V. Hasemore replied.

Orders Recently Booked

Birmingham Electric Furnaces, Ltd., has received orders from the Alvis Car & Engineering Co., Ltd., Coventry, for electric furnaces to carry out the whole of the heat treatment at the new Alvis aero engine factory. The equipment comprises "Birlec" furnaces for nitriding, stabilising, carburising and reheating; also for the complete heat treatment of steel and aluminium alloy forgings and castings. Other special furnaces are being installed for the heat treatment of high-speed and carbon steel tools and cutters.

Messrs. William Steward & Co., Ltd., have secured the contract for the electric-discharge lighting installation at the Philco Radio & Television Corpn. factory at Perivale. Altogether 240 discharge lamps are being employed.

Telephone Cables for Yugoslavia

An expenditure of 200 million dinar is proposed by the Belgrade Ministry of Posts for the supply of telephone cables for the modernising of the network, payment to be made in sixteen instalments extending over eight years. Foreign cable makers who have tendered for the delivery are reported to have refused to accept these terms and to have made counter proposals.

Siemens Managers' Conference

Messrs. Siemens Bros. recently held their annual conference of home branch managers and the London management. It is interesting to learn that the aggregate service of those present amounted to 497 years, the average individual figure being over twenty-six years.

New Australian Tariff

Dr. Earle Page, Minister of Commerce and Deputy Prime Minister in the Australian Commonwealth Government, who is at present visiting London, announced on May 22nd that the new Australian tariff proposals would, it was expected, increase the annual value of Australian imports of United Kingdom goods by over £3,000,000. According to *The Times*, among the goods placed under licence are wireless receivers, parts and valves; electric refrigerators; lamps, except those for motor-vehicles; storage batteries for motor vehicles; electric light and power cables; household vacuum cleaners; carbon manufactures; electric fans; electrical fittings, partly or wholly of metal; electric cooking and heating appliances; and Diesel and heavy oil engines.

A Lighting Code

A "Lighting Code" giving a list of recommended values of illumination for various purposes, has been prepared by the Technical Committee of the Illuminating Engineering Society (6d.). The main classifications in foot-candles are:—Above 50: Precision work; tasks requiring rapid discrimination and response displays. Between 25 and 50:—Severe and prolonged visual tasks such as fine engraving, sewing of dark goods, and discrimination of fine details of low contrast. Between 15 and 25:—Prolonged critical visual tasks, such as proof-reading, type-setting, drawing, reading, fine machine work, fine assembling, sewing on dark goods, large stores. Between 8 and 15: Visual tasks such as detailed office work, skilled bench-work, and sewing of light goods, retail shops. Between 5 and 10:—Less exacting visual tasks, such as general office, large assembly work, class-rooms. Between 3 and 5:—Work of simple character not involving fine details. Between 2 and 4:—Casual observation.

An Electric Mechanical Horse Demonstration

Members of the Railway Clearing House Committee showed considerable interest last Friday in a demonstration by the Corporation of Electric Transport, Ltd., Morrison electric vehicle distributors for the South of England, of a 2-ton electric mechanical horse and trailer at Euston Square. On account particularly of its low operating costs, reliability, and ease of manœuvring (it has a turning circle of only 16 ft.) this class of vehicle appears to have a promising future for the type of haulage work associated with railway depôts. The model demonstrated was fitted with standard 60-V Exide batteries giving it a range of about 30 miles per charge, but larger batteries can be used to extend the range of the vehicle. Fully loaded, the maximum speed is 10 to 12 m.p.h. A special delay-action foot controller makes it impossible for the driver to start off at top speed or to change up too quickly from first to top. Both foot and hand brakes operate on all four rear wheels. On the vehicle shown the trailer was fixed permanently to the horse, but detachable models can be supplied if desired.

Electrical Ironmongers

In a note upon the annual conference of the Ironmongers' Federated Association in our last issue we stated that the Electrical Section of the I.F.A. now had 107 members. This number, however, was the *increase* in membership during the past year.

A Davidson Patent

In our issue of May 15th last, we made reference to the successful petition of patentees before Mr. Justice Luxmore in the Chancery Division, for leave to amend their specification relating to improved apparatus for the separation and removal of dust and grit from dust-laden air or from the gaseous products of combustion of furnaces. In reporting the matter we referred to the letters patent granted to "a Mr. Davidson." Actually this should have read "granted to Messrs. Davidson & Co., Ltd., Belfast."

Loading Cable-drums and Transformers

The H.F. dual crane illustrated was built for Kingston Corporation by Messrs. Harvey, Frost & Co., Ltd., for the loading and unloading of cable drums and transformers for transport. The load is lifted from the ground level into the vehicle in one operation. The crane occupies no useful floor space, as

The Kingston mobile crane (Harvey Frost, Ltd.) lifting a drum of cable

it forms an integral part of the bodywork of the petrol engined lorry.

Silk Screen Printing Exhibition

The Association of Display Producers & Silk Screen Printers is to hold the first exhibition of silk screen printing at the First Avenue Hotel, High Holborn, W.C.1, from June 9th to 11th.

Social Events

Messrs. A. Reyrolle & Co., Ltd., are holding their annual sports meeting on June 13th on the company's recreation ground at Hebburn. The programme includes thirty-two events of wide variety, and among the prizes are four challenge cups and the inter-departmental shield presented by the directors of the company. As last year, a series of races is to be run between teams representing Messrs. A. Reyrolle & Co., Ltd., J. H. Holmes & Co., Ltd., C. A. Parsons & Co., Ltd., and the Bushing Co., Ltd. It is also hoped to run a race including teams representing other firms on Tyneside.

More B.I. Maps

Its first series of street maps proved so popular that British Insulated Cables, Ltd., has produced a second series dealing with a further forty-eight towns. A historical *resumé* is given with each map.

Bauxite in Italy

Deposits of bauxite have been discovered in the Aidussina district near Gorizia. The Italian National Prospecting Committee is already following up this new find of ore, which extends for a distance of over 9 km., with the object of studying the possibilities of mining it. Chemical analysis of the ores has revealed a high percentage of aluminium.—*Reuter's Trade Service.*

The Indian Market

A firm doing extensive business in India wishes to secure sole agencies in that country for electric lamps, house-service meters, ironclad switch- and fuse-gear, cinema carbons and welding electrodes. We shall be pleased to forward communications from manufacturers.

A Demonstrators' Course

The London School of Electrical Domestic Science is holding a one-week refresher course for electrical demonstrators from July 27th to July 31st. Particulars can be obtained from the Principal, Imperial Court, Basil Street, Knightsbridge, S.W.3.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, May 27th: Copper bars (best selected), sheet and rod, £68, £2 decrease. Spelter, £14 7s. 6d., 2s. 6d. decrease. English block tin, £201, £1 increase. No change in the price of English pig lead.

Messrs. Frederick Smith & Co. report, May 27th: Electrolytic copper bars, £41 2s. 6d., 12s. 6d. decrease. Ditto, ditto, wire rods, £47 5s., 10s. decrease. Ditto, ditto, h.c. wire, 7⅞d., ⅛d. decrease. Silicium bronze wire, 8¼d., ⅛d. increase.

Messrs. Edward Till & Co. report, May 27th: No change in the price of India-rubber, Para fine.

For Sale

The Postmaster-General invites tenders for the purchase of telephones micro, table telephones, &c.

Oswestry Electricity Department has for disposal one 80-kW oil engine and one 100-kW rotary convertor.

(See our classified advertisements.)

Trade Announcements

Messrs. Michael Black, Ltd., have removed to 138, West George Street, Glasgow, C.2.

With reference to the announcement which appeared under this heading in our issue of May 8th, the Mirrlees Watson Co., Ltd., asks us to state that while it has the sole rights for the manufacture and sale of Mirrlees-Vogel submersible pumps to be manufactured by the company for the countries named, Messrs. Kittell & Co., London, retain their selling right for pumps manufactured at Messrs. Vogel's Works, Austria.

The works of Messrs. Parmiter, Hope & Sugden, Ltd., Longsight, Manchester, will be closed from the evening of June 3rd until Monday morning, June 8th.

Messrs. Arnolds (London), Ltd., have opened premises at 149, Haverstock Hill, London, N.W.3, for the display of electrical and radio equipment. With its imitation sycamore wall-panels, and built-in "Mistoberry" and "Efesca" fires, the showroom provides an artistic setting for the "out-of-the-ordinary" lighting equipment now on view. Special cooker and refrigerator displays are contemplated later.

An Up-to-date Stores Installation

In order to facilitate alterations to displays at the new Finchley Road, Hampstead, premises of Messrs. John Barnes & Co., Ltd., floor traps at 12 to 15 ft. intervals give access to a two-compartment steel-duct system which houses all the high- and low-voltage cables. The Hampstead Borough Council Electric Supply Department has installed a sub-station in the basement to provide a duplicate supply for the 2,000-A load, and in the main intake room the latest type of Drake & Gorham main switchboard with Brush switchgear has been used. The subsidiary switch and fuse gear was supplied by the General Electric Co., Ltd., and made up by the Major Equipment Co., Ltd., which was also responsible for the concealed trough lighting in the restaurant and arcades and for some unusual window-lighting equipment. The latter is arranged in the form of a honeycomb, and a draught-board effect can be produced by switching off alternate lights. Swivel brackets enable the lamps to be focused on the goods displayed. For the concealed lighting ordinary Royal Ediswan pearl lamps 9 in. apart are employed. Attractive G.E.C., totally enclosed fittings illuminate the general stores. The subsidiary lighting of the restaurant comes from three-tier wall-brackets (Troughton & Young, Ltd.) erected on mirrors, one lamp of each fitting being connected with the "Keepalite" emergency lighting system. Low-voltage ceiling panels plastered over have been installed all over the building by Messrs. G. N. Haden & Sons, Ltd., who have also carried out a plenum system of ventilation, the air entering through grilles in the ceiling and passing out through unobtrusive openings high up on the walls. In the kitchen and snack-bar Messrs. Benham & Sons, Ltd., have fitted a considerable amount of electrical equipment, while perishable foodstuffs for both the restaurant and for the provision department are stored in Frigidaire apparatus. The Smith's electric clocks throughout the store are combined with a staff-locating system giving seven combinations. Connecting the three floors are Waygood-Otis escalators. The electrical contractors were the Berkeley Electrical Engineering Co., Ltd., who employed Henley cables throughout. Neon signs were installed by the Major Equipment Co., Ltd., interior signs being supplied by the K.F.M. Engineering Co., Ltd. One of the present attractions of the new building is a television demonstration enabling people in different rooms to speak to and see each other.

French Domestic Appliance Imports and Exports

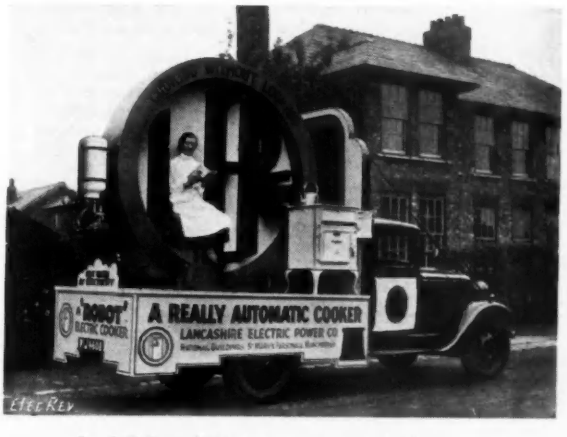
The appended table shows the French imports of domestic electrical appliances during 1935 as compared with the preceding year. The French franc totals have been converted into sterling at 75 fr. to the £.

	1934. 1,000 frs.	1935. 1,000 frs.
Fires and stoves	4,150	3,038
Irons	148	57
Vacuum cleaners, boot cleaners, etc.	3,985	2,214
Refrigerating machines, etc.	17,637	13,458
Fans	1,033	631
Total fr.	26,953,000	19,398,000
Total at 75 fr. to the £	£359,373	£258,640

It will be seen that the imports show a falling off of no less than £100,733, or over 28 per cent., the decline applying to all the scheduled items. As regards the exports from France of similar material, no details are given in the official return beyond the gross total which last year amounted to only £128,253 as compared with £159,547 in 1934.

A Carnival Lorry

The accompanying illustration shows the Lancashire Electric Power Co.'s carnival van which was awarded the first prize in the trades section of a carnival at Stoneclough, near Kearsley, on May 16th. As will be seen, the theme was automatic cooking by means of thermostatically controlled cookers. The two girls, one on each side of the 8-ft. cut-out letters of the company's monogram, were sitting in comfort and "cooking without looking." The electric cookers displayed were English Electric models with thermostatically controlled ovens



An L.E.P. prize-winning carnival tableau

of the type which is being offered by the L.E.P. Co. throughout its area, and which is invariably chosen by the consumer in spite of a slightly higher charge in preference to the old orthodox cooker with three-heat control. To complete the rear of the display was a Santon self-contained storage water-heater. The colour scheme of black letters and orange, green and cream decorations, proved very attractive and struck the right note for carnival week.

Indian Import Trade

From the statistics now made available by the Government of India it is seen that the imports of electrical machinery during 1935-36 amounted to Rs.205 lakhs as against Rs.168 lakhs in the previous year. Of the total imports, Rs.137 lakhs worth came from the United Kingdom, representing an increase of Rs.16 lakhs compared with the previous year. Imports from Germany increased from Rs.21 lakhs to Rs.29 lakhs, while those from the United States rose from Rs.12 lakhs to Rs.16 lakhs,

and those from other countries from Rs.14 lakhs to Rs.22 lakhs. The trade has been steadily increasing during the last four years. As regards the kinds of machinery imported, control and switchgear rose from Rs.39 lakhs to Rs.44 lakhs, generators, alternators, &c., from Rs.16 lakhs to Rs.21 lakhs, motors from Rs.35 lakhs to Rs.42 lakhs, transformers from Rs.12 lakhs to Rs.19 lakhs, turbo-generator sets from Rs.4 lakhs to Rs.7 lakhs, and others from Rs.61 lakhs to Rs.70 lakhs. The imports of electrical instruments and apparatus rose from Rs.281 lakhs in 1934-35 to Rs.308 lakhs in 1935-36. In this section of the trade also there has been a steady rise during recent years. The share of the United Kingdom is naturally the largest, and increased during the year from Rs.162 lakhs to Rs. 175 lakhs. Germany's share increased from Rs.31 lakhs to Rs.37 lakhs, that of the United States from Rs.30 lakhs to Rs.38 lakhs, and that of Japan from Rs.16 lakhs to Rs.18 lakhs. Imports from Netherlands were stationary, while those from other countries declined to some extent. Imports of fans and parts rose from Rs.25 lakhs to Rs.32 lakhs; those of wires and cables rose from Rs.87 lakhs to Rs.93 lakhs; batteries from Rs.15 lakhs to Rs.20 lakhs; lighting accessories and fittings from Rs.6 lakhs to Rs.8 lakhs; and telegraph and telephone instruments from Rs.14 lakhs to Rs.18 lakhs. The imports of wireless apparatus increased from Rs.16 lakhs to Rs.28 lakhs, of which Rs.10 lakhs came from the United Kingdom and Rs.13 lakhs worth from the United States,

Estonian Electrical Imports

Under the influence of the general industrial revival in Estonia in recent years the demand for electrical machinery, apparatus and accessories has increased substantially. The total value of imports of this group last year amounted to 2,850,000 kr. (the rate for the Estonian kr. is approximately 18 to the £) against 1,830,000 kr. in 1934. Excluding trade in wireless materials, Germany's share was 70 per cent. in 1935, as compared with 60 per cent. in 1934. The outstanding item among imports of electrical goods is wireless apparatus and parts. Imports of these nearly trebled between 1934 and 1935, and in the latter year reached a value of 1,110,000 kr. A good business was done in sets from Holland at low prices, Germany and the United Kingdom coming next in order of importance in this trade, with the United States very close to Great Britain. The market for new receiving sets is expected to increase after the erection of the new transmitting station. Imports of dynamos, motors and parts and of transformers totalled 210,000 kr. in value, with Germany accounting for 150,000 kr. and the United Kingdom and Sweden for the remainder. Of accumulators and batteries (to the value of 31,000 kr.) nearly one quarter came from Germany and the same proportion from the United Kingdom, with Sweden next in importance as a supplier. Nearly all the meters imported were of German origin, and the same country was the largest supplier of lamps, namely, 200,000 kr., out of 340,000 kr. The United Kingdom does not seem to have done much of the business in cable or wires, Germany and Finland being the principal suppliers, and Germany supplied most of Estonia's requirements in switches, fuses, &c.

The South African Year Book

The 1935-36 edition of the *Official South African Municipal Year Book* (London agents: Edw. G. Allen & Son, Ltd., 25s. net) has just been received. Considerable attention has again been given to engineering and electricity supply and the sections dealing with these matters, data, &c., are prepared in such a comprehensive manner as to form a comprehensive reference to the whole of South Africa.

A Lighting Installation at Leeds Town Hall

The Leeds Town Hall was opened by Queen Victoria in 1858. The building occupies a site area of 6,257 sq. yds. and the main hall is known as the Victoria Hall, the dimensions of which are 161 ft. long, 72 ft. wide and 75 ft. high, while it has a seating capacity for approximately 2,000 people. This lofty hall has a wonderful ceiling which, in the past, was not apparent because of the indifferent lighting, and the great height. After redecoration, it was felt that an improved equipment of lighting fixtures was essential, to do justice to the structure, and seven main lighting units of solid bronze, which virtually carry out the lighting of the whole hall, have been erected, being supplemented by nine smaller fixtures, of a similar style, under the gallery. The vertical and horizontal metal sections of fixtures carry chased work, and the arrangement of spheres, round the upper rim of the main fixtures, has not only softened the severity of the design, but has in addition afforded a measure of subdued floodlighting in an upward direction. These fixtures are 34 ft. long and weigh with their retaining gear 10 cwt. each. It was decided that the complete fixture must be designed and made so that every strain was carried by duplicate members. Every internal strut and cross member is in duplicate. Two one-piece solid steel tubes, concentric to one another, form the main suspension. They are shrouded externally with a bronze tube, and although the raising and lowering is carried out by safety winches, of the worm gear type, no weight is carried by the steel ropes after the fixtures reach the ceiling. At that point, massive steel clamps close round the central steel tubes, and steel girders support the weight. There is approximately 3-kV of lamps in each fixture. The hand-bent glass panels are of heavy section, sprayed golden amber, and the bronze metal-work is lacquered to the finish of old gold. An important result that has been achieved is the absence of glare, particularly as regards the occupants of the gallery. It has just been decided to put an almost similar lighting fixture in the vestibule. The whole of this installation has been carried out by the Sun Electrical Co., Ltd.

The Victoria Hall of the Leeds Town Hall, showing the new lighting fittings recently installed by the Sun Electrical Co., Ltd.

New Catalogues and Lists

"Autoset" Sales, Ltd., 14, New Bridge Street, London, E.C.4.—A loose-leaf catalogue of trucks, trolleys, castors and wheels.

Norrington & Landon, Ltd., 33, Brazennose Street, Manchester, 2.—A cut-out leaflet illustrating the "Blaizolite" projector.

Rawlplug Co., Ltd., Cromwell Road, London, S.W.7.—Two new cut-outs advertising an adjustable ball-bearing spanner and a fixed ratchet spanner.

Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester, 6.—A pamphlet on the "Overseas" all-wave aerial kit.

Reeves Barlowe, Ltd., 4, Upper Marylebone Street, London, W.1.—Details of the "Barlograph" arc-engraver.

Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham, 5.—A leaflet, shaped like a switch-fuse case, dealing with the "Memroy" all-insulated switch-fuse.

Two views of the works of British Electric Domestic Appliances, Ltd., showing the production of "Aerofrige" refrigerators. The picture on the left shows the compressor unit assembly side and the other the mechanical unit and cabinet assembly and test shop

Tangyes, Ltd., Cornwall Works, Birmingham.—"Tangye Activities," a new booklet illustrating typical examples of the company's up-to-date machinery (pumps, oil engines, hydraulic machinery, &c.).

Cooper Roller Bearings Co., Ltd., King's Lynn.—A catalogue of split patent roller bearings, containing details of installations in which these bearings are used.

Darlington Forge, Ltd., Darlington.—A new illustrated catalogue giving a graphic idea of the work undertaken by the recently re-opened forge.

Delco-Remy & Hyatt, Ltd., 111, Grosvenor Road, London, S.W.1.—A manual of refrigerator motors, which also contains a catalogue of available "Delco" motors.

Victor X-ray Corporation, Ltd., 15, Cavendish Place, London, W.1.—Two booklets dealing with a new "Maximar" X-ray therapy unit and a high-voltage X-ray generator.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—An illustrated catalogue containing full technical details of centrifugal fans with forward, radial and backward bladed fan wheels.

Electromagnets, Ltd., 2, Church Street, Colmore Road, Birmingham, 3.—A leaflet dealing with magnetic separators.

S. Taylor & Sons, 6, Eagle Street, London, W.C.1.—Details of "Bardisk" pendulum bell indicators.

Siemens Brothers & Co., Ltd., Woolwich, London, S.E.18.—A new pocket size catalogue with a stiff cover having rounded corners. This describes an extensive range of telephones and accessories for private installations.

British Insulated Cables, Ltd., Prescot.—Booklets dealing with braided aerial cables and wires, static condensers for the elimination of radio interference, window lead sections, primary batteries and iron-clad service cut-outs.

Higgs Motors, Ltd., Witton, Birmingham, 6.—New catalogue sections describing industrial electric motors, totally enclosed crane and hoist motors, change-speed squirrel-cage motors, stator and rotor units, plain bearing motors, protected d.c. motors, vertical spindle motors, repulsion start induction machines, gear units, and polishing and grinding motors.

E.M.B. Co., Ltd., Moor Street, West Bromwich, Birmingham.—Crane protective panels are described in a new pamphlet.

Cooper Stewart Engineering Co., Ltd., 136, Long Acre, London, W.C.2.—"Frozen Dainties" is the title of a booklet giving recipes for dishes in the preparation of which a refrigerator can be used.

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—An abridged catalogue of electric fans.

Bulpitt & Sons, Ltd., Camden Street, Birmingham, 1.—A leaflet describing a new "Speedee" wash-boiler, and a folder, cut to the shape of a kettle, entitled "Why is the Element inside the Kettle?"

Revo Electric Co., Ltd., Tipton, Staffs, has produced an illustrated 250-page art catalogue bound in a stiff cover. It deals with a wide range of electric lighting equipment including poles and reflectors.

Bankruptcy Proceedings

H. Rollason, 61, Stafford Street, Derby, electrical contractor.—The public examination in this matter was held at Derby on May 19th. The statement of affairs filed disclosed gross liabilities of £259 and assets estimated at £15. Debtor said that he was employed as an electrical engineer until March, 1923, when he became a partner in an electrical contracting business. In March, 1928, he commenced trading on his own account as an electrical contractor with a capital of £35 given him by his wife, who later gave him a further £25. The turnover of that business averaged £1,000 a year for about four years, but in 1933 the Derby Corporation introduced a direct-labour scheme in connection with electrical installations, as a result of which there arose cut-price competition between electrical contractors for other available work. His turnover gradually declined, and as the result of creditors pressing he filed his petition. The examination was closed.

Ivy Holdsworth, trading as the Carlton Manufacturing Co., 20b, York Road, Leeds, wireless dealer.—The public examination was held on May 19th at Leeds, when it was disclosed that there were gross liabilities of £498 and assets of £1. Debtor said her failure was due to lack of capital, bad trade, and the effects of a slum clearance scheme. She commenced business in September, 1933, with her savings of £50, but there had been considerable defaulting by customers who had obtained sets on hire-purchase terms. The examination was formally adjourned for closing.

E. H. Newman and **D. E. Newman** (Newman & Co.), radio and electrical engineer, 17, Shepherd's Bush Green, London (separate estate of E. H. Newman).—Last day for receiving proofs for dividend June 6th. Trustee, Mr. S. W. Hood, Bankruptcy Buildings, Carey Street, W.C., Official Receiver.

J. G. Raad (Rardo Radio & Television Co.), wireless dealer, 62, Stamford New Road, Altrincham.—Receiving order made May 12th on debtor's own petition. Public examination June 12th at the Court House, Quay Street, Manchester.

L. Marson, electrical contractor, 81, Norwood Road, Herne Hill, S.E.24.—First and final dividend of 1s. 9d. in the £, payable at Bankruptcy Buildings, Carey Street, W.C.

W. Hodge, electrical engineer, 3, Saltash Street, Plymouth.—First and final dividend of 8s. 2d. in the £, payable June 4th at Balfour House, Finsbury Pavement, E.C.

J. Cameroff (J. Cameron), electrical engineer, 43, Camp Road, Leeds.—Trustee, Mr. H. C. Bowling, 24, Bond Street, Leeds, Official Receiver, released May 8th.

Company Liquidations

Thompson Manufacturing Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. A. C. Malzer, 41, Montrose Avenue, Whitton, Middlesex. The business is to be transferred to a new company of the same name, the registration of which is recorded on page 800 of this issue.

Orbit Traversing Fan Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. E. Hill, 19, Coleman Street, E.C. Particulars of claims to the liquidator by June 22nd.

Rex Radio Corporation, Ltd.—Meeting June 15th at 8, Queen Street, E.C.4, to receive an account of the winding-up by the liquidator, Mr. E. Harper Stringer.

Mains Power Radio, Ltd.—Meeting June 16th at 407-309, Moorgate Station Chambers, Moorfields, E.C., to receive an account of the winding-up by the liquidator, Mr. K. D. Hutton.

Architectural Lighting Ltd.—Particulars of claims by June 19th to the liquidator, Mr. E. Boswell-Philips, 8, Frederick's Place, Old Jewry, E.C.2.

Private Arrangement

H. S. S. Thornes, "Lynwood," Swyncliffe, Gomersal, electrician, &c.—The creditors of the above met recently when a statement of affairs was submitted which showed ranking liabilities of £402, and, in addition, there were fully secured creditors for £1,248. After allowing £12 for preferential claims the net assets were £639, giving a surplus of £237. The debtor, it was stated, commenced business on his own account in 1919 with a capital of £80. For some years he was successful, although no accounts had been prepared up to 1928 and no information was available as to the trading between 1921 and 1927. It had, however, been ascertained that at April 1st, 1927, the debtor's capital account was in credit to the extent of £350. Creditors had commenced proceedings and in order to protect the estate a deed of assignment had already been executed to Mr. J. W. Thompson, of Leeds. It was resolved that, as there was a surplus of assets over liabilities and every probability that the creditors would receive 20s. in the £, the deed already executed should be confirmed. A committee was also appointed consisting of the representatives of four of the principal creditors.

Dissolution of Partnership

R. N. Jackson & Co., electrical contractors and maintenance engineers, Southampton Street, Ringwood.—Messrs. R. N. J. Jackson and F. A. Hekking have dissolved partnership. Mr. Jackson will attend to debts and carry on the business.

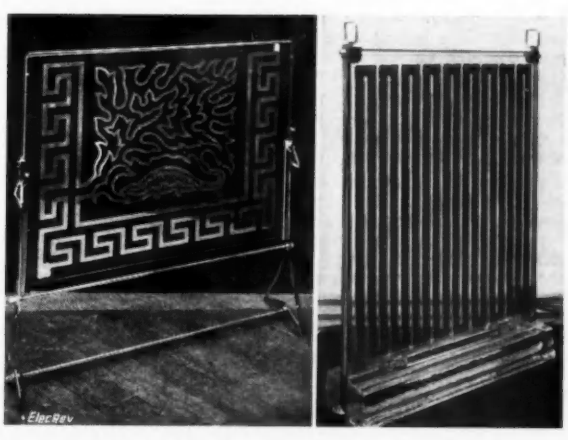
Hardy Glass

THE ability of "Armourplate" glass, manufactured by Pilkington Bros., Ltd., to bend, bear a load three to four times greater than ordinary glass, and withstand violent impacts and great heat, is now made use of in a number of different ways, as an exhibition which is being held this week at the Building Centre, New Bond Street, W.1, shows.

Of outstanding interest is an electric radiator utilising glass plates to radiate the heat. Held together by a light chromium-plated frame, two glass plates are mounted vertically close to one another, face to face, but not touching. A conductor of some secret preparation is deposited in a pleasing pattern on the inside of the glass, which itself becomes hot and radiates the heat. As there is no glow, a red tell-tale tubular lamp is incorporated in the base of some of the models.

Even the smaller type with a loading of only 750 W gives an excellent heat over a wide area, and experimental models have been in continuous use for several months without any signs of deterioration. The experimental stage is now completed and the company will start production shortly.

A high-voltage insulator which has repeatedly been tested up to a load of nine tons without any sign of failure of the glass is another exhibit worthy of note. It has a very high resistance to mechanical impact and, in the unlikely event of its being broken in service, the glass shatters and makes damaged insulators easily visible from the ground, thus simplifying the location of faults. Other items on view are an oven with a glass door which does not become steamy, garage inspection lamps, miners' lamps, marine floodlights and an illuminated traffic bollard which was demolished in a collision, the "Armourplate" glass remaining intact. Twisting and other tests are also carried out at the exhibition.



Glass panels actually radiate the heat in these two new fires. The pattern is, in fact, the "element" deposited on the inside surfaces of the glass

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—CHANGE-OVER.—Application is to be made by the Corporation for permission to change over the supply from d.c. at 220 V and 440 V to (1) single-phase, 230 V, 50 cycles, and (2) three-phase, 400 V, 50 cycles.

Bexhill.—RURAL EXTENSION.—The Corporation is to provide a supply to the Glyne Farm estate at a cost of £2,804.

Bournemouth.—STREET LIGHTING IMPROVEMENTS.—The Lighting Committee is to take steps to reorganise and improve street lighting by electricity in the main roads, and by gas and electricity equally in the case of secondary roads.

Bromley.—NEW TARIFF.—The Town Council has adopted an alternative rate for cinemas and theatres of £8 per annum per kVA demanded, plus ¾d. per kWh for the first 15,000 kWh per quarter, ⅜d. per kWh for the next 15,000 kWh, and ¼d. per kWh beyond. The present tariff is a flat rate of 2½d. per kWh, or alternatively £11 per kW of maximum demand per annum, plus ¾d. per kWh.

Chester.—EXTENSION OF SUPPLY.—A scheme for the provision of a supply to the Hoole district at a cost of £6,200 has been approved by the Electricity Committee.

Colwyn Bay.—ILLUMINATIONS.—Approval has been given by the Council to an expenditure of £5,000 on illuminations during the next five years.

Coventry.—STREET LIGHTING.—The Watch Committee is to provide equipment at a cost of £2,000 in connection with electric street lighting.

NEW SUB-STATION EQUIPMENT.—The Electricity Committee is seeking sanction to borrow £17,287 for sub-stations and equipment.

Croydon.—LOANS.—Sanction has been obtained by the Electricity Committee to a loan of £16,973 for mains and £14,200 for plant.

EXTENSIONS.—The Electricity Committee is to extend its mains to supply the Kendra Hall estate at a cost of £940.

Eastry.—ELECTRICITY REPLACES GAS.—The Rural District Council has decided to substitute electricity for gas for public lighting at Minster, Eastry, Wingham, Elvington and Sholden.

Farnborough.—DISPUTE SETTLED.—A compromise has been arranged between the Urban District Council and the Mid-Southern Utility Co. with respect to overhead lines at Tower Hill. At the suggestion of the inspector at a recent inquiry, it has been arranged that an underground cable shall be laid, the Council undertaking to reinstate the surface after the cables have been laid without cost to the company.

Fleetwood.—ILLUMINATIONS.—The electrical engineer has been instructed to prepare a general scheme of special illuminations.

France.—INCREASED OUTPUT.—Electricity production figures for March show that the improvement which was noted at the end of last year continues. The total output was 2,959,380,000 kWh, representing an increase of 8.02 per cent. over March, 1935.

Gateshead.—CABLE-LAYING.—The Town Council has been notified that the North-Eastern Electric Supply Co., Ltd., proposes to lay cables in Eastbourne Avenue, Westbourne Avenue, Claremont Avenue, Oakwood Gardens, Thornwood Gardens, Elderwood Gardens, Beechwood Gardens, Bewick Road and Derwentwater Road.

Glasgow.—A LARGE LOAN.—Sanction has been obtained by the Corporation to a loan of £300,000 for mains and services.

Great Yarmouth.—NEW EQUIPMENT.—Sanction is being sought by the Electricity Committee to a loan of £19,208 for a duplicate 15,000 kVA transformer and switchgear at the power station.

Jarrow-on-Tyne.—PLEBISCITE FOR ELECTRICITY.—A plebiscite is being taken among 800 occupiers of Council houses to ascertain whether electric lighting shall be installed. At present the dwellings are supplied with gas only.

Kettering.—PUBLIC LIGHTING EQUIPMENT FOR HIRE.—The Electricity Committee recommends arrangements with public lighting authorities for the supply on hire or hire-purchase of electrical equipment for public lighting.

London.—CAMBERWELL.—The opening stage of the new electric street-lighting system by which the whole of the streets of the borough (approximately 140 miles) are for the first time to be lighted electrically by the County of London Electric Supply Co., Ltd., was completed on Tuesday, when the new lighting was switched on at Crystal Palace Parade. The ceremony was performed by the Mayor of Camberwell (Coun. A. C. Warwick) who, speaking from the Centre Transept of the Palace, said that the scheme as a whole was probably the largest change-over from gas to electric street lighting ever undertaken in Europe. It would be finished by next spring.

FULHAM.—It is reported that a further loan of £10,000 is required for the new central sub-station, and the Finance Committee has recommended that this sum should be made available. The same committee has also had under consideration the question of financing the expenditure incurred on the re-equipment of electricity sub-stations throughout the borough consequent upon the change-over of the C.E.B. main transmission system. The total estimated cost, apart from the new central sub-station, is £74,000. The Electricity Commissioners have sanctioned borrowing to the extent of £20,200, and the committee suggests that the balance of £53,800 should be charged to reserve.

It was originally intended to install separate electric radiators in each office and room of the new generating station, the estimated cost being £1,000. However, as the thermal storage system has been rapidly developed during the last two or three years, the borough electrical engineer recommends that this method should be substituted, as it would be more suitable and economical for heating the offices, switchgear houses, and control and battery rooms of the new station. The capital cost is estimated at £5,000. The Electricity and Lighting Committee is satisfied that the saving in running costs will more than offset the additional initial expenditure. Furthermore, the load will be better distributed, while it is probable that the original estimate of £1,000 for electric radiators would be considerably exceeded owing to the increased cost of labour and materials.

It is also proposed to install electric thermal storage heating equipment in the new maternity home at Parson's Green. A communication has been received from the Minister of Health stating that, although the cost of the installation (£3,335) is greater than that of competitive heating systems, he will raise no objection to the proposal if the Council is satisfied that the advantages (cleanliness, ease of manipulation and freedom from noise) justify the extra cost.

BERMONDSEY.—The Health Committee is to provide lamps for the solarium at the new health centre in Grange Road at a cost of £2,490.

HACKNEY.—As an experiment the Borough Electricity Department has erected about twenty-five concrete street-lighting standards in Lauriston Road. They were manufactured by Concrete Utilities, Ltd., and carry G.E.C. "Difractor" lanterns with 500-W gas-filled lamps. The innovation is in connection with the Council's general scheme for improving the lighting in the borough, and it will be extended to other streets if satisfactory.

An attractive type of concrete street lighting standard erected experimentally in Lauriston Road, Hackney

L.C.C.—The Hospitals Committee of the London County Council recommends the provision of an electric scrubbing machine for the Bethnal Green Hospital similar to that which is used at the Hammersmith Hospital.

Lowestoft.—MAINS AND SERVICES.—The Electricity Committee is seeking sanction to borrow £13,000 for mains and services.

Merthyr Tydfil.—REDUCED CHARGE.—The Merthyr Electric Traction and Lighting Co. has reduced the charge for lighting to 6d. per kWh, as from the end of the March quarter.

Portsmouth.—SUBMARINE CABLES.—Sanction to lay submarine cables to Gosport has been obtained by the Electricity Committee.

Redcar.—SUPPLY TO ESTATE.—The Electricity Committee is to extend mains at a cost of £300 to provide a supply to the Kirkleathan estate.

Seaham Harbour.—LOAN.—Sanction has been received by the Urban District Council to a loan of £1,000 for electric apparatus.

Southend-on-Sea.—ELECTRICITY FOR BATHS.—The Town Council is to supply electricity for the water-heating plant at the Westcliff swimming baths at 0.21d. per kWh, subject to a guaranteed minimum consumption of 500,000 kWh per annum.

DECORATIVE LIGHTING.—The borough electrical engineer has been authorised to hire out transformers and strip lighting for the illumination of consumers' premises.

SUPPLY PROGRESS AND PROBLEMS.—Apart from the usual statistical information, the 1935-36 annual report of Mr. A. C. Johnson, borough electrical engineer and manager, raises several topics of general interest. On the subject of rate contributions he points out that such relief has to be given from the net profits of the undertaking, and that for every £1 contributed £1 6s. 2d. has to be raised to meet income-tax at the rate of 4s. 9d. in the £. Furthermore, the gross profit must be increased in order to meet the annual contributions, and as gross profit has an important bearing on the quinquennial assessment, it follows that a higher assessment and, incidentally, higher rates, must ensue. During 1935-36 contributions in aid of rates and illuminations at Southend amounted to £40,269, and averaged nearly 0.2d. per kWh sold. Another point of interest relates to the collection of accounts. In his annual report for the years ended March 31st, 1934 and 1935, the District Auditor expressed the opinion that this should be done by the Finance Department, but Mr. Johnson disagreed, and it is expected that the present system of collection by both the Electricity and Finance Departments will remain. The modern trend in charging for domestic supplies is towards a two-part tariff, but at Southend the "contract" rate under which payment is made in advance continues to find favour, over 14,000 consumers being so supplied. It consists of a fixed charge per quarter in respect of a definite lighting demand, supplies for domestic appliances being provided through a separate meter at a low price per kWh. With regard to progress, comparison with the previous year is difficult owing to the incorporation of new areas of supply. It is, however, noteworthy that both the increase of 10,600,000 kWh sold (making the total 49,500,000 kWh) and the proportionate advance of 27.3 per cent. are records in the history of the undertaking. Other details will be given at a later date in our usual table of municipal supply undertakings' results.

Stanhope (Co. Durham).—STREET LIGHTING.—The Parish Council is to extend its electric street lighting system to Frosterley. Plans have been prepared by the North-Eastern Electric Supply Co., and tenders are invited.

Swansea.—ELECTRIC REFRIGERATORS.—A sum of £5,000 is to be spent by the Electricity Committee on domestic refrigerators. These are to be available to the public on hire-purchase terms over a period of five years.

EXTENSIONS TO ESTATES.—Mains are to be extended to the Gower and Trewydffa estates.

Switzerland.—USE OF DOMESTIC ELECTRICAL APPARATUS.—According to the results of a recent inquiry, states *Swiss Industry and Trade*, the amount of household electrical apparatus in use has considerably increased during the past few years. Electric cookers now number 87,000 and water heaters 138,000. There are approximately 129,000 small motors and nearly 1,000,000 small thermal appliances of all kinds connected to the mains, while the number of lamps in use is 9,400,000. Bearing in mind that the population of the country is only in the neighbourhood of 4,000,000, it is evident that the degree of utilisation of domestic electrical apparatus is high. The fact that there are 59 per cent. more electric water heaters than cookers is noteworthy. In Great Britain, according to the returns of 264 of the 650 electricity supply undertakings up to September last, the number of electric cookers in use was more than three times that of water heaters.

Syria.—A DIFFICULT YEAR.—The Société de Tramways et Electricité de Damas, in its report for last year, gives details of the difficulties experienced by the company owing to a boycott by the public. To meet the complaints, fares on the tramways and the charges for power supply were reduced last November, but in spite of this the position became worse, so much so, that it was decided to suspend the working of the tramways altogether. The future of the company under existing conditions is so unpromising that it has brought the matter to the notice of the French High Commissioner in Syria. Actually, the trouble is political in origin.

Thurrock (Essex).—LOAN FOR EXTENSIONS.—The Urban District Council is to borrow £6,000 for extending its electricity services in Grays.

United States.—"FREE" ELECTRICITY.—Another spring offer of "free" electricity is being made by Milwaukee Electric Railway & Light. This time customers who elect to use twice as much energy as in the corresponding month of 1935 may have the additional power for an added payment of only 10 per cent. If more than double the amount used a year ago is taken the balance will be charged at 2 cents per kWh. This will be the third year that some such spring offer has been made, the policy having been inaugurated in 1934, states the *Electrical World*.

RURAL ELECTRIFICATION.—According to a *Reuter* message from Washington, President Roosevelt has signed the Norris Bill authorising the expenditure of $410,000,000 (£82,000,000) spread over the next ten years on rural electrification.

Wakefield.—LOANS.—The Electricity Committee has obtained sanction to borrow £10,000 for sub-stations and equipment and is seeking a further loan of £4,700 for cables and switchgear.

Wales.—RURAL SUPPLY AGITATION.—At a meeting of the Council of Agriculture for Wales, held at Shrewsbury on Wednesday, Mr. W. Edwards was to move, on behalf of the standing committee, "That in view of the slow rate of progress hitherto made in the electrification of rural areas and the importance of securing more rapid development, this Council again urges the Government to take steps to confer upon county councils in Wales and Monmouthshire powers to undertake the distribution of electricity within their areas."

Wellingborough.—MAINS EXTENSIONS.—The Wellingborough Electric Supply Co. proposes to lay underground mains in Northampton Road, and from Doddington Road through the Council's housing estate.

Weymouth.—LOAN.—Sanction to borrow £23,841 for mains, services and plant has been obtained by the Electricity Committee.

EXTENSION.—Arrangements have been made for the provision of a supply to Bincleaves torpedo range at a cost of £1,582.

Traction

Argentina.—DIESEL-ELECTRIC RAIL-COACHES.—A recent issue of the *Schweizerische Bauzeitung* gives details of four metre-gauge Diesel-electric rail-coaches which have been constructed by Sulzer Bros., of Zurich, for a local railway in the Buenos Aires district. The vehicles, which are to take the place of steam trains, are mounted on two bogies and have an overall length of 65 ft., their weight being between 43 and 44 tons. Accommodation is provided for twenty first-class and forty-three second-class passengers. The engines, which are rated to develop 270 h.p. at 1,100 r.p.m., drive two generators (main and auxiliary) mounted on the same shaft.

Belgium.—UNDERGROUND RAILWAY FOR BRUSSELS.—According to *Eclairage et Force Motrice*, an Anglo-Belgian syndicate is interested in a project for the construction of an underground electric railway in Brussels. The scheme provides for a circular line with twelve stations serving the busiest parts of the city.

NEW RAIL COACHES.—At a recent meeting of the board of directors of the Belgian State Railway Exploitation Co., in Brussels, approval was given for the preparation of plans for a number of new types of electric rail-coach, for use on direct services on the electrified sections of the system during the quiet mid-day periods and also on local lines where frequent stops are required to be made.

Denmark.—ADDITIONAL ROLLING STOCK.—The Danish State Railways have placed orders for thirty-one new trailer coaches for the Copenhagen electrified suburban traffic in order that the standard train formation may be raised from three to four vehicles.

France.—NEW ELECTRIFIED RAILWAYS.—The French State Railway authorities are quadrupling the lines on the Paris-Argenteuil Railway between Bois-de-Colombes and Stade-de-Colombes, and electrifying two of the lines on this section and two between Stade-de-Colombes and Argenteuil. Both sections will be operated at 650 V, d.c. In connection with the work a new remotely controlled sub-station has been erected at Argenteuil, the equipment comprising four 1,000-kW convertors. The electric line between Paris, Chartres and Le Mans is being changed over from 650 V to 1,500 V, d.c., operation. Preparations are also being made for the electrification of the nine-mile section between Argenteuil and Sainte Honorine, in connection with which two automatic 650-V mercury rectifier sub-stations are to be provided. The electrification of the Tours-Bordeaux line, which is included in works for the relief of unemployment, is to be put in hand, states a *Reuter's Trade Service* message, the order for the commencement of the work having been given. The project is a big one, involving an expenditure of 400,000,000 francs, and two years will elapse before the electrification work on the line, which is 350 km. long, is completed. This will bring the length of electrified line belonging to the Orléans Company to 1,003 km., and will provide electric traction in France from Paris to the Spanish frontier at Irun. The power will be provided partly by the Marèges hydro-electric station, belonging to the P.O. Company, and partly by the stations belonging to the Midi railway in the Pyrénées, and the supply will be distributed to the lines by fourteen sub-stations at intervals of 25 km., transforming the three-phase 90,000-V 50-cycle supply to 1,500-V d.c. The sub-station plant will include two groups of two 750-V rotary convertors in series, the same as those used at the Paris-Brive and Orléans-Tours sub-stations.

Holland.—SPEED TRIALS FOR ELECTRIC TRAINS.—It is stated that speed trials will be held in the coming months on the line between Amsterdam and Rotterdam with the existing electric trains. No passengers will be carried, and it is expected that 75 miles per hour will be reached.

London.—TRANSPORT CONVERSION.—The latest information issued by the London Passenger Transport Board in connection with its transport conversion scheme states that by the end of this year 750 trolley-buses will be in service. The order in which routes will be converted is as follows: Acton to Edgware; Cricklewood to Finchley; Stonebridge Park Depôt (Cricklewood) to Paddington (providing a service from Paddington to Edgware); and Stonebridge Park Depôt (Cricklewood) to Sudbury (providing a through service from Paddington to Sudbury). The Shepherd's Bush to Uxbridge route will also be converted this year. With the introduction of trolley-buses on some of these routes, about 100 "Feltham" tramcars will be released for service elsewhere. These vehicles, the Board's most modern type of tramcar, will be transferred, as they become available, to the Streatham Depôt.

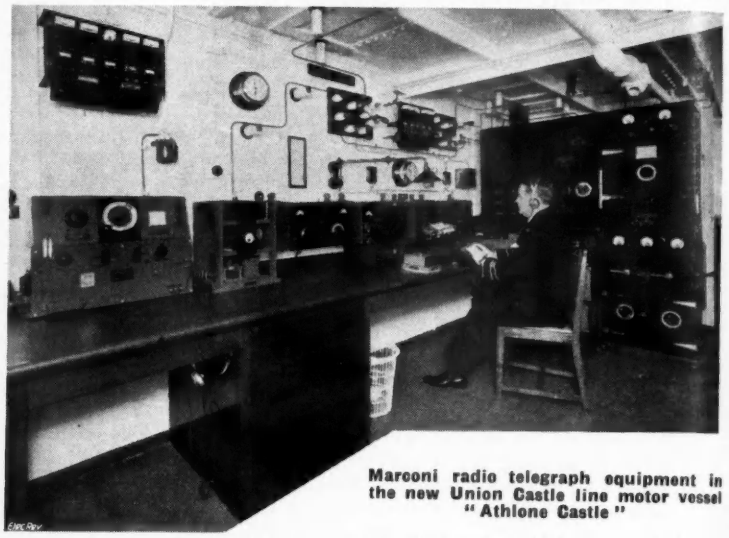
Scotland.—Trolley-buses in Cities.—In a paper read at the annual conference of the Scottish Road Passenger Transport Association at Pitlochry on May 22nd Bailie V. D. Warren, Glasgow, urged the adoption of the trolley-bus system in large cities. He pointed out that the London Passenger Transport Board had 200 such vehicles in operation, and that they were proving successful. He claimed that from the point of view of mobility, safety, cheapness and running cost they were superior to the petrol or oil bus, and added that Scottish cities should become more up-to-date in matters of transport. There was certainly not a motorist, and scarcely a pedestrian, who did not think that the days of the tramcar, with its fixed rails in the centre of the city roadway, were numbered. If the tramcar, with its heavy expense in the maintenance of rails, could be made to pay as handsomely as it did in Glasgow, he could not see why there should be so much fear of an experiment with the trolley-bus. The converted Glasgow electric subway, although it served a limited area, would pay for its electrification within five years. This seemed to indicate that further underground transport might be remunerative. Mr. R. Stuart Pilcher said that in Manchester they were soon to put electrically controlled vehicles on a certain route and the result would be watched closely. He did not think that changing over to railless traction would avoid taxation. The Chancellor would not willingly lose his revenue. Self-propelled vehicles were always preferable, but in the event of a breakdown trolley-buses would cause as much confusion as tramcars. Mr. J. L. Gunn, Nottingham, remarked that Nottingham was the largest municipal operator of trolley-buses in the United Kingdom. It paid them, yet the oil-engined vehicle was definitely cheaper than the trolley-bus. He contended that it was a fallacy to believe that where the tramcar system was in operation it was an easy matter to change over to railless traction.

Southern Railway.—Portsmouth Electrification.—The Southern Railway Co. has placed an order for nineteen dining cars and nineteen kitchen cars to form parts of the new train sets being built at Eastleigh for the Portsmouth electrification. Of this rolling stock the dining cars are to be built by the Metropolitan-Cammell Carriage & Wagon Co., Ltd., and the kitchen cars by the Birmingham Railway Carriage & Wagon Co., Ltd.

Communications

China.—New Broadcasting Station.—It is reported from Shanghai that preparations are being made in Nanchang for the establishment of a large broadcasting station to supplement the small station of the provisional headquarters of the President of the Chinese Military Affairs Commission.

Great Britain.—Reduced Charges for Transatlantic Calls.—From July 1st next the charge for telephone calls between this country and the first zone of the United States and Canada (including New York and Montreal) will be reduced from £2 to £1 8s. per min. (10 a.m. and 10 p.m.), and from £1 8s. to £1 per min. (10 p.m. to 10 a.m.), minimum three minutes. The reduced night charge will apply throughout Sundays. There will also be concessions in the case of other zones, and Cuba and Mexico.

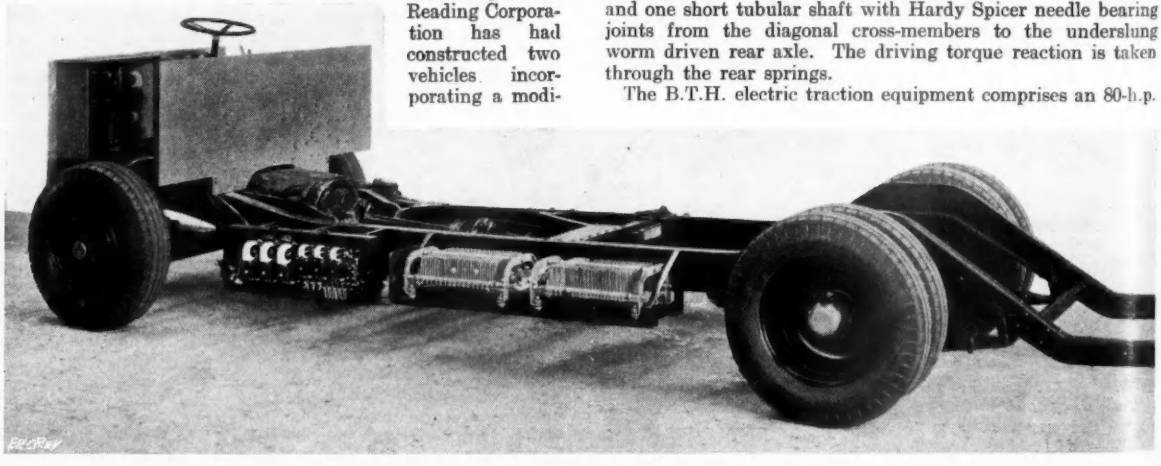


Marconi radio telegraph equipment in the new Union Castle line motor vessel "Athlone Castle"

Scotland.—Radio-telephony.—A radio-telephone service linking up the Orkney and Shetland Islands was inaugurated on May 23rd.

Low-built Double-deck Trolley Buses

In our issue of February 7th last we published an article describing the type M.F.2 Sunbeam-B.T.H. trolley-bus chassis supplied to the Johannesburg Corporation, and vehicles of this design have also been delivered to various other municipalities, including Wolverhampton, Portsmouth and Durban. To operate its first trolley-bus service on roads where there are low bridges, the Reading Corporation has had constructed two vehicles incorporating a modified type of this chassis (M.F.2a). The maximum height (unladen) of the double-deck vehicle is only 13 ft. 11 in. over the trolley poles at the base, which is from 18 to 20 in. lower than the orthodox bus. The makers claim that this is the lowest type of double-deck trolley-bus to be put into service in this country.



The new Sunbeam-B.T.H. M.F.2a trolley-bus chassis; the main contactor panel mounted on the near-side chassis frame member, on the same side as the main resistances, and the forward-placed motor can be seen

The main difference from type M.F.2 is in the position of the motor and the arrangement of the transmission line. The motor is mounted immediately behind the front axle, with a low chassis frame and no projections above the level of the frame to affect the main floor height. Careful designing has enabled this forward position of the motor to be obtained without interfering with its accessibility for inspection and maintenance, and the motor can be dropped from the chassis frame for overhaul, &c., without disturbing the axle assembly. The transmission line from the motor consists of two solid shafts with "Layrub" joints supported on the frame cross-members and running in self-aligning spherical roller bearings, and one short tubular shaft with Hardy Spicer needle bearing joints from the diagonal cross-members to the underslung worm driven rear axle. The driving torque reaction is taken through the rear springs.

The B.T.H. electric traction equipment comprises an 80-h.p. motor arranged for regenerative and rheostatic braking, the latter operating from 15 to 2 m.p.h. Park Royal double-deck bodies are fitted. They are of composite construction with a sunken gangway on the upper deck.

One of the vehicles is provided with equipment for manœuvring, in case of emergency, by means of two 24-V 100-Ah Oldham batteries. A switch connects the two batteries in series, and enables the bus to be propelled for short distances independently of the line supply. The chassis weight, including all electrical control gear, collector gear, dynamo and 100 A batteries, is 4 tons 1 cwt. 3 qr.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdeen.—June 15th. Town Council. One 15,000-kW turbo-alternator with condenser and auxiliary plant. (May 22nd.)

Alcester.—June 22nd. R.D.C. Installation of a vertical spindle sludge pump and a sludge elevator with electric motors, pipes, fittings, &c., at the Studley sewage disposal works. Engineer and surveyor, Bleachfield Street (deposit £2 2s.).

Angus.—County Council. Various works, including electric lighting, at extensions of Infectious Diseases Hospital, Forfar. R. H. Anderson, County clerk, County Buildings, Forfar.

Annan (Dumfriesshire).—June 4th. Town Council. Electrical work at Waterfoot Road housing estate. Town clerk, Town Hall.

Australia.—Melbourne.—June 8th. State Electricity Commission of Victoria. Steel reinforced aluminium conductors and accessories. (May 15th.)
July 20th. Switchgear and accessories. (T.Y. 30156.)*

Bedford.—June 4th. Electricity Department. Meters, water heaters, cookers, cooker control units, kettles, meter boards and cut-outs for twelve months ending September 30th, 1937. (May 22nd.)

Birmingham.—June 12th. Electric Supply Committee. E.h.v. and l.v. cables at Hams Hall power station. (May 22nd.)

Blackpool.—June 16th. Borough Council. 6,600-V 3-phase compound filled metal-clad draw-out switchgear for twelve months. (See this issue.)

Brighton.—June 11th. Corporation. Electrical work in seventy-four houses in Piltdown Road, Nuthurst Road and Wiston Road. W. N. C. Clinch, engineer and manager, "Electric House," Castle Square (deposit £1 1s.).
June 15th. Corporation. One 27-panel, single bus-bar, metal-clad, draw-out type switchboard for the Southwick power station. (See this issue.)

Croydon.—June 15th. Electricity Department. Stores and materials for twelve months. (May 22nd.)

Dumbarton.—Town Council. Electrical lighting at 200 houses. Borough engineer, Municipal Buildings.

Ealing.—June 4th. Electricity Department. Cables, meters, cut-outs, jointing materials, conduits, frames and covers and general stores, for twelve months ending July 31st, 1937. (May 22nd.)

Egypt.—Alexandria.—June 27th. Ports and Lighthouses Administration. Electrification of the Port of Alexandria (3rd section). Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1 (deposit £2 1s., not returnable).

Epsom and Ewell.—June 15th. U.D.C. Electricity Department. Steel kiosk, h.v. switchgear, transformer, l.v. cable and multiple stoneware conduits (May 22nd.)

Fife.—June 16th. County Council. Electric lamps for schools, hospitals, &c. G. Sandilands, County master of works, Property and Works Department, Wemyssfield, Kirkcaldy.

Gainsborough.—June 13th. Electricity Department. One 400-kVA, 6,600/400-V transformer. (See this issue.)

Haslemere.—June 1st. U.D.C. Electric lighting in twenty-six houses on the Eight Acres estate, Hindhead. C. A. Best, surveyor to the Council, Council Offices, Museum Hill.

Irish Free State.—Dublin.—June 19th. Corporation. Electrically driven sewage pump at the main pumping station, Pigeon House. City engineer, 28, Castle Street (deposit £2 2s.).
June 19th. Electricity Supply Board. Meters during one year commencing September 1st next. (See this issue.)

Kincardineshire.—June 3rd. County Council. Electrical and heating works at the Isolation Hospital, Stonehaven. D. and J. R. McMillan, architects, 105, Crown Street, Aberdeen.

Leyton.—June 19th. Corporation. Removal of existing fittings, re-spacing and wiring and re-instating the electric lighting installations at two schools. (May 22nd.)

Lincoln.—June 6th. Electricity Department. One 300-Ah accumulator battery. (May 22nd.)

London.—Metropolitan Water Board.—June 19th. Four oil engines with centrifugal pumps and electrical generators, two electrically and one water turbine driven borehole pumps, two booster pumps, switchboard and appurtenant works at the Orpington pumping station. Chief engineer, Room 235, 173, Rosebery Avenue, London, E.C.1 (deposit £2 2s. to the accountant).

Manchester.—June 8th. Waterworks Committee. Two electrically driven, multi-stage, centrifugal pumps with automatic switch and control gear, pipes, valves, &c., for erection at Wythenshawe. Chief engineer, Waterworks Offices, Town Hall (deposit £1 1s.).
June 10th. Electricity Committee. 6,600-V single conductor p.i. lead alloy sheathed cable for the Stuart Street power station and/or the High Street stores, Chorlton-on-Medlock. (See this issue.)

Middlesex.—June 17th. County Council. Electrical installation at the new County school, Pinner. (See this issue.)
July 1st. Electric lighting, road lighting, power, clocks, bell systems, telephone, fire alarms, lightning conductor, distribution cables and switchgear at the Chase Farm schools, Enfield. (See this issue.)

Douglas (I. of M.).— Electricity Undertaking. 3,750-kW. turbo-alternator, etc. (See this issue.)

Musselburgh (Midlothian).—June 1st. Town Council. Various works, including electrical, at 100 houses. Borough surveyor.

Newcastle-upon-Tyne.—June 12th. Transport and Electricity Committee. One 200-kVA, 3-phase, 6,600/440-V, 50-cycle transformer. (See this issue.)

Northern Ireland.—Belfast.—June 6th. Electricity Committee. High temperature furnace bricks. (May 22nd.)
June 13th. Electricity Committee. Steam pipework, armour-clad switchgear, static transformers and town water service main. (See this issue.)

Nottingham.—June 9th. Electricity Committee. General stores for twelve months from July 1st, 1936. (May 22nd.)

Oldbury.—June 4th. Education Committee. Electric lighting at the Rounds Green school, Brades Road, and the Rood End schools, Rood End Road. Borough engineer and surveyor, Municipal Bank Chambers.

Preston.—July 7th. Electricity Department. House service type electricity meters, domestic water-heating apparatus and breakfast cookers. (May 15th.)

Richmond (Yorks).—June 3rd. Electricity Department. Two h.v. oil switch cubicles, two l.v. pedestal type switches and two 350-kVA transformers. (May 22nd.)

Sheffield.—July 1st. Electricity Committee. Steam and water piping, including steam receivers, valves, &c., for the Neepsend generating station. (See this issue.)

South Africa.—Pretoria.—June 5th. Public Works Department. Electric lighting fittings. (T.Y. 30166.)* Three electric lifts. (T.Y. 30165.)*
June 12th. Union Tenders and Supplies Board. Stationary batteries. (T.Y. 30168.)*

Southampton.—June 9th. Electricity Department. Meters. (See this issue.)

Southport.—June 10th. Town Council. Electrically driven centrifugal pump, rotary air compressor and steam heater, including starter, switches, cables, &c., at the Victoria Baths. A. E. Jackson, borough engineer, Town Hall.

South Shields.—June 8th. Corporation. Electrical fittings and lamps for the six months ending December 31st, 1936. (May 15th.)

Stoke-on-Trent.—June 8th. Sewage Purification Department. Electrically driven vertical spindle type pumping plant for extensions and alterations to Hanford sewage pumping station (No. 1) and Austin Street ejector station (No. 2). City sewage engineer, Leek Road (deposit £2).
City Council. Electric wiring and fittings for (a) ninety-two houses and (b) 184 houses on the Hollywall Lane site, Goldenhill. Chief architect, City Architectural Department, Kingsway, by May 30th (deposit £2).

Stretford.—June 15th. Corporation. Sewage, storm water and sludge pumps with electric motors, starters, &c., and screening plant, grab and gantry. E. Parker, borough engineer (deposit £2 2s.).

Swansea.—June 2nd. Electricity Department. Metal-clad switchgear, h.v. cubicles and l.v. sub-station feeder panels. (May 22nd.)

Tredegar.—June 20th. U.D.C. Pole lines, underground cables, switchgear, and a 250-kVA transformer. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Australia. — Commonwealth. — P.M.G.'s Department. Accepted. Automatic switchboard equipment (£137,918).—British General Electric Co. Jumper rings and terminal strips (£442).—Phœnix Telephone & Electric Works, Ltd. Automatic telephone switchboard equipment (£4,096).—Standard Telephones & Cables (A'sia), Ltd.
Victoria.—Melbourne City Council. Accepted. 33,000 yd. bare copper cable (£1,087).—B. I. Cables, Ltd.—*Tenders.*

Bedford.—Electricity Committee. Recommended. Evaporator plant renewals (£594).—P. & B. Evaporators, Ltd. Transformers for twelve months.—British Electric Transformer Co.

Bexhill.—Electricity Committee. Recommended. H.v. ring main switchgear (£327).—A. Reyrolle & Co. L.v. switchgear for the De La Warr Pavilion and Town Hall sub-stations (£633).—W. Lucy & Co.

Cowdenbeath.—Town Council. Accepted. Electric lighting at 112 houses.—T. S. Miller, Dunfermline.

Croydon.—Highways Committee. Recommended. Traffic signals at three junctions (£1,089).—Automatic Electric Co.
Electricity Committee. Recommended. Battery repairs (£353).—Britannia Batteries, Ltd. Two feeder switches for power station (£2,495).—Met. Vick. Elecl. Co. Cooling tower repairs (£437).—Davenport Engineering Co.

Dunfermline.—Town Council. Accepted. Electrical installation at the 134 houses to be built at Headwell and sixteen houses at Low Beveridgewell.—Miller & Stables. Electrical wiring at 128 houses at the Headwell West scheme.—J. Scott & Co.

Durham.—County Education Committee. Accepted. Electrical installations in schools: Newbottle (£237).—T. Binks & Son. Seaham Harbour Deneside (£140).—T. B.Watson & Son. Junior Instruction Centre, Bishop Auckland (£54) and Urpeth Lodge Junior Instruction Centre (£165).—R. Robson, Willington. Birtley (£117).—T. W. Atkinson, Oxhill.

Grimsby.—Electricity Committee. Recommended. Kiosk sub-stations at Ludborough, Utterby and North Ormsby (£582).—W. Lucy & Co.

Kirkcaldy.—Town Council Accepted. Electric lighting work at 250 houses on the King Street housing scheme (£2,268). —J. G. Woodcock.

Lanark.—County Council. Accepted. Electrical installation at eighty-four houses to be built at Dykehead, Shotts.—A. and C. Edelman, Ltd., Glasgow.

London.—HACKNEY.—Works Committee. Recommended. Two new batteries for electric vehicles each consisting of Exide-Ironclad cells with a capacity of 323-Ah (after allowance of £31 for each of the old batteries) (£201 each).—Chloride Electrical Storage Co.

Electricity Committee. Recommended. Installation of inter-office telephones at the electricity showrooms and offices (£745).—Reliance Telephone Co.

ST. MARYLEBONE.—Electricity Committee. Recommended. Laying ducts, drawing-in and jointing cables (£7,856).—Constable Hart & Co. Cables for twelve months.—Telegraph Const. & Maint. Co.; B.I. Cables, Ltd.; Enfield Cable Works, Ltd.

L.C.C.—Wiring and fittings for the rewiring of certain portions of Grove Park Hospital, Lee :—

	£		£
J. H. Plant, Ltd. Accepted ...	**547**	B. French, Ltd.	609
Berkeley Electrical Engg. Co. ...	581	J. E. Swann and Co.	610
T. Clarke and Co.	595	Davis Myer and Co.	625
A. Hawkins and Sons	598	A. J. Hewens and Sons	668
F. G. Edey and Co.	599	Gillham and Jones	685
		L. G. Tate and Co.	748

Wireless equipment at St. Mary, Islington, hospital :—

	£		£
F. W. Smurthwaite, Ltd. Accepted	**637**	Bell Brothers and Co. (London), Ltd.	753
H. J. Cash and Co.	688	Archibald Meckhonik	771
J. E. Swann and Co.	705	Buchanan and Curwen, Ltd. ...	780
Pinching and Walton	733	Malcolm and Allan (London), Ltd.	859
Electrical Installations, Ltd. ...	745	T. Clarke and Co., Ltd. ...	897
Francis Polden and Co.	752	Gillham and Jones	1,271

Housing and Public Health Committee. Accepted. Completion of the work of wiring and fittings for electric lighting, &c., in 234 occupied houses at Becontree (in lieu of previous tenders) (£1,782).—Springvale Electrical Co.

Lowestoft.—Electricity Committee. Accepted. Cables (£1,112). —Callender's.

Redcar.—Electricity Committee. Accepted. Two transformers (£367).—Bruce Peebles & Co.

Southend-on-Sea.—Town Council. Accepted. Equipment for the illumination scheme.—Imperial Lighting Co. (£292); E. Clifford Seaton (£726); Waite & Son (Mitcham) (£148); Telegraph Const. & Maint. Co. (£127). Electrical refrigeration plant for the public mortuary (£282).—Leda Electric, Ltd.

Swansea.—Electricity Committee. Accepted. Cable (£1,760 per 1,000 yd.), barrier joints (£65 each), and straight through joints (£26 each).

Assistance Committee. Accepted. Automatic telephones (£112).—Reliance Telephone Co.

Weymouth.—Electricity Committee. Accepted. Change-over in Dorchester Road area : Cable (£2,046).—Johnson & Phillips, Ltd. Wireless apparatus, &c. (£1,406).—V. H. Bennett & Co.

Forthcoming Events

Institution of Electrical Engineers.—Monday, June 15th, to Saturday, June 20th. Summer meeting in Scotland.

London Students' Section.—Saturday, June 13th. Summer visit to the Rothamstead all-electric farm, Harpenden.

Hampshire Sub-Centre.—Thursday, June 18th. Summer visit to the Portsmouth electricity undertaking and Shippam's potted meat factory, Chichester.

South Midland Centre.—Tuesday, June 30th. Summer meeting. Visit to the works of the British Thomson-Houston Co., Rugby, and inspection of the Shakespeare Memorial Theatre, Stratford-on-Avon.

Physical Society.—Friday, June 5th. Bedford College, London, N.W.1. 5 p.m. Short papers.

Incorporated Municipal Electrical Association.—Monday, June 8th, to Saturday, June 13th. Convention in Edinburgh.

Oxy-Acetylene Welding Congress.—Monday, June 8th, to Saturday, June 13th. Caxton Hall, London, S.W.1.

Institution of Mechanical Engineers.—Tuesday, June 9th, to Friday, June 12th. Summer meeting at York.

Institution of Civil Engineers.—Wednesday, June 10th. Institution, London, S.W.1. Annual conversazione. Tuesday, June 16th. Institution, London. "The Development of the Sao Paulo Hydro-Electric Scheme." Mr. A. W. K. Billings.

Tramways, Light Railways and Transport Association.—Wednesday, June 10th, to Friday, June 12th. Annual congress at Brighton.

Chemical Engineering Congress.—Monday, June 22nd, to Saturday, June 27th. Central Hall, London, S.W.1.

Institution of Heating and Ventilating Engineers.—Monday, June 22nd, to Wednesday, June 24th. Cliftonville, Margate. Summer meeting. "Heating Research." Mr. A. F. Dufton.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following :—

WOLF MORGAN motors.

Small carbon-filament lamps (1 to 5w. at about 10v.).

Readers should enclose stamped addressed envelopes when making their inquiries.

Notes

I.E.E. Transmission Section Paris Visit

At the invitation of the Société Française des Electriciens, a week-end visit to France of the Transmission Section of the Institution of Electrical Engineers has been arranged to take place from July 17th to 20th. There will be a visit to Creney, near Troyes, to see a recently equipped trunk switching station at 220 kV, and to the St. Denis terminal station with a cable section at the same voltage. A short visit will also be made to the power station at St. Denis (new block). English-speaking French engineers will explain what is being done in France with regard to the hiring and hire-purchase of appliances; installations; tariff principles; show-room demonstrations and propaganda methods; relationships with wiring contractors; easy-term wiring; cooking and storage heating problems; sites for transformers; and rural electrification. Full details will be available later, but members of the Section wishing to take part should notify the secretary of the Institution now. Participants may make their own travelling arrangements, but the main party will leave Victoria station on Friday evening, July 17th, at 8.20 p.m., travelling *via* Newhaven and Dieppe. Week-end tickets can be used, with which no passports are required. No arrangements can be made for the inclusion of ladies in the party. The cost will be about £6 from London.

I.E.E. South Midland Outing

The annual summer meeting of the South Midland Centre of the Institution of Electrical Engineers on June 30th will take the form of a visit to the works of the British Thomson-Houston Co., Ltd., Rugby, where luncheon and tea will be provided, followed by an inspection of the Shakespeare Memorial Theatre at Stratford-on-Avon and attendance at the evening performance. Ladies are specially invited and tickets (14s. 6d. each) must be obtained before June 15th from Mr. H. Hooper, 65, New Street, Birmingham.

I.E.E. Benevolent Fund Golf Competition

The annual golf competition held in aid of the benevolent fund of the Institution of Electrical Engineers (Mersey and North Wales (Liverpool) Centre) was played at Hoylake on the links of the Royal Liverpool Golf Club on May 13th, ninety members and friends taking part. The tournament comprised a singles competition under bogey and medal scoring, a four-ball also against bogey, and a putting competition. At the close of play, Mr. Oscar C. Waygood, chairman of the centre, presided at dinner in the club-house and presented the prizes. The G. P. Dennis trophy was won by Mr. F. E. Spencer, chairman-elect of the Centre, and other prize winners were Messrs. L. F. M. Ryley, J. K. Abel, T. K. Whyte, G. M. Daniels, G. P. Dennis (senior), W. H. Owen, W. Foster, P. W. Davis, C. W. Waygood and H. R. S. Preston.

Post Office Exhibition

The inner workings of the Post Office are revealed at an interesting exhibition opened this week at Charing Cross Underground Station. Visitors are finding a particular fascination in one of the forty tube trains, which run, without drivers or guards, through 6½ miles of tunnels from one side of London to the other, carrying 30,000 mail bags a day. How the Post Office carries out maintenance work on its 10,500,000 miles of underground wires is demonstrated in a full-size replica of a cable manhole. Some of the cables used contain nearly 3,000 wires. A stamp obliterating machine dealing with 600 letters a minute, teleprinter apparatus, and portions of the equipment used in automatic telephone exchanges, which now deal with 2,750,000 calls daily in London alone, are also attracting considerable attention. The front portion of the exhibition indicates the extent to which the radio broadcasting service is dependent on the G.P.O. land-lines. The positions of the Post Office radio transmitting and receiving stations are shown on an illuminated map. The exhibition will continue until June 13th.

Appointments Vacant

Lecturer in engineering at the Cape Technical College, Capetown.

Salesman canvasser for Cheadle and Gatley Electricity Department.

Consumers' engineer for Worksop Electricity Department.

Distribution engineer for the Settle and District Electricity Co., Ltd.

Electrical engineering assistants for the Air Ministry.

Assistant, Grade I, for the Royal Aircraft Establishment, South Farnborough.

Shift engineer for Bradford Electricity Department.

Chief assistant engineer and consumers' engineer for Finchley Electricity Department.

Resident engineer for the Irrigation Department (Hydro-electric) of the Government of the United Provinces, India.

Sub-engineer, technical assistants and engineering clerks-of-works, for the Electro-Mechanical Branch of the Office of the Receiver for the Metropolitan Police District.

Assistant in the Departments of Electrical Engineering and Mathematics at the Dundee Institute of Art and Technology.

(See our classified advertisements.)

Head of the Giled Engineering Department, Rutherford Technical College.

Male costing clerk for Gravesend Electricty Department.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Dr. H. Vickers, head of the Department of Electrical and Mechanical Engineering, University of British Columbia, has submitted his resignation and, according to the official monthly organ of the American I.E.E., he is to take up a position with a leading British concern engaged in technical electrical work. A native of Chester, England, he graduated from the University of Liverpool in 1912 with the degree of Master of Engineering. Subsequently he received the degrees of M.Sc. and Ph.D. from the University of Birmingham. He served with Siemens Bros. & Co., Ltd., and with the British Westinghouse Electric & Manufacturing Co., Ltd., (now Associated Electrical Industries, Ltd.), and in 1920 he was appointed chief consulting engineer to Messrs. Campbell & Isherwood, Ltd., serving at the same time as senior lecturer at the University of Birmingham. In 1923 he became chief assistant at the Finsbury technical college, and the following year he accepted his present position in British Columbia.

Mr. E. V. Caton, manager of the Winnipeg (Manitoba) Electric Co., has been elected vice-president of the Engineering Institute of Canada, states the same journal. Born at Hove, England, in 1884, Mr. Caton was educated at Brighton College and Sheffield University. He served his apprenticeship with a Hove electrical concern, and for a time he was on the staff of Crompton & Co. (now Crompton Parkinson, Ltd.). From 1907 until 1912 (when he went to Canada) he was chief assistant in the testing department of Vickers, Ltd.

Mr. H. V. Field, B.Sc., Wh.Sch., M.I.E.E., of Forest Hall, Northumberland, acting principal and head of electrical engineering at Rutherford Technical College, Newcastle-on-Tyne, has been appointed principal of the Constantine Technical College, Middlesbrough. He served his apprenticeship at Chatham Dockyard and was educated at the City and Guilds Engineering College, London. Later he was appointed senior lecturer of electrical engineering at Loughborough. He has been at Rutherford College since 1927.

Mr. H. V. Field

Mr. L. E. Wilson has been elected chairman of the Manchester branch of the Electrical Contractors' Association.

Mr. G. Campbell, chairman and managing director of Benjamin Electric, Ltd., is paying a short business visit to the United States, and sailed in the *Queen Mary* on her maiden trip from Southampton on May 27th.

Mr. E. W. Golding, M.Sc.Tech., A.M.I.E.E., M.Amer.I.E.E., who contributes the article on "Storage Heater Losses" (page 782) received his technical education at the College of Technology, Manchester, and was awarded a post-graduate research scholarship. Between 1924 and 1926 he was on the staff of the Met.-Vick Research Department, and since then he has been lecturer in Electrical Engineering at University College, Nottingham. He is the author of "Electrical Measurements and Measuring Instruments" (Pitman), this subject being one of his special interests.

Col. K. W. E. Edgcumbe has been elected a member of the Board of the Institute of Physics and will take office on October 1st next, at the beginning of the 1936-37 session.

Mr. G. A. McLennan was elected president of the Lothians branch of the Association of Mining Electrical Engineers, for the ensuing year at the recent annual meeting of the branch.

Mr. P. N. Mitra, Deputy Director-General of Telegraph Traffic in India, is retiring after several years' service. Mr. Mitra was responsible for many reforms on the engineering side of the Telegraph Department. He was sent to Kashmir State to reorganise the telegraph service. While serving as Assistant Director-General and Controller of Telegraphs (1920 to 1929), he went as a delegate to the International Telegraph Conference, Paris, in 1925, the International Radio Conference, Washington, in 1927, and the International Conference, Brussels, in 1929.

Mr. F. O. J. Roose, electrical engineer to the Government of Bombay, has been granted six months' leave preparatory to retirement, after having served in the Presidency for sixteen years. Educated at Westminster and the London Polytechnic Engineering School, Mr. Roose was articled to a firm of consulting engineers. He was assistant resident engineer in the South London tramway construction works of the London County Council for a short time, and he then spent several years abroad as chief engineer at Curdolia and later in South America, Brazil and Argentina. He went to India in 1919 as electrical engineer to the Government of Bombay.

Mr. C. B. B. Smith-Bingham has been elected a director of the Metropolitan Electric Supply Co., Ltd.

Mr. S. F. S. Whitehouse has been appointed assistant installation engineer with the Yorkshire Electric Power Co. He received his education at the Doncaster Technical College and the University of Sheffield, and holds the degrees of B.Sc.(Eng.), (London), and B.Eng. (Sheffield). In 1935 he was appointed assistant electrician with the Bullcroft Main Collieries, Ltd., Doncaster, and three years later joined the technical staff of the Electrical Department of the Doncaster Collieries Association, Ltd., with whom he remained until 1934, when he became sales engineer with the British Central Electrical Co., Ltd. In the following year he was appointed technical officer, Engineering Branch, Metropolitan Police, New Scotland Yard.

[Jerome

Mr. S. F. S. Whitehouse

Mr. G. Ewart has resigned from the board of Messrs. John Shaw & Sons, Wolverhampton.

Obituary

Mr. A. Bolton, whose death occurred recently in his eighty-third year, entered the service of the United Kingdom Telegraph Co. seventy years ago. In 1869 he was transferred to the Telegraph Department of the Post Office at Leeds, where he attained the rank of assistant superintendent (acting superintendent), from which position he retired after forty-seven years' service.

Mr. W. H. Robins.—The death occurred on May 23rd, at his home, "The Beeches," Stone Road, Stafford, of Mr. William H. Robins, electrical engineer to the Stafford Corporation. Mr. Robins had been ill for about eight months, although in February he partially resumed his duties, but his illness recurred about a week before his death. He started at the Stafford electricity works at the age of twenty-one, and had been in the service of the Department for thirty-four years at the time of his death, having succeeded Mr. Meade as engineer in 1913. When the Stafford generating station was taken over by the North-West Midlands Joint Electricity Authority in 1930, Mr. Robins continued with the Stafford Corporation in charge of the distribution side.

Mr. W. T. E. Blunden.—We regret to record the death of Mr. W. T. E. Blunden, general lamp sales manager of Philips Lamps, Ltd., which occurred on May 22nd at the Royal Northern Hospital, London, following an operation. Mr. Blunden, who served in the Royal Air Force during the war, had held the position of general lamp sales manager with Philips since the company's formation.

The late Mr. W. T. E. Blunden

Mr. W. R. Joss.—The death occurred recently at Ipswich of Mr. William Rae Joss, at the age of fifty-eight. Mr. Joss was technical advisor and consulting engineer to the Stamford Electrical Co.

Mr. C. Duncan, who was for forty-five years in the Telegraph Department at the General Post Office, Dundee, died at Dunblane, Perthshire, on May 22nd, at the age of seventy-nine. Mr. Duncan played a part in the evolution of wireless telegraphy by making several improvements to the early type of apparatus. He retired nineteen years ago.

Mr. T. A. Bullock.—The death occurred on May 15th, at Putney, at the age of eighty-six, of Mr. Thomas A. Bullock, who was for some years the London superintendent of the Eastern Telegraph Co. The interment took place at Putney Vale cemetery on May 19th.

Will.—Mr. T. E. Bingham, managing director of Messrs. Barber & Colman, Ltd., left £8,045.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Unit Appliances & Service (Yorks), Ltd.—Private company. Registered May 20th. Capital, £750. Objects: To carry on the business of manufacturers of, agents for and wholesale and retail dealers in electrical and mechanical apparatus, accessories, fittings, components and supplies, and in particular vacuum cleaners, washing machines, refrigerators, radiators, fires, stoves, radio sets, radio-gramophones, &c. The directors are: R. C. Peel, 3, Wellhouse Avenue, Leeds; and D. W. Craven, 10, Roman Gardens, Street Lane, Leeds. Registered office: Diamond House, 4, The Headrow, Leeds, 1.

H.O. Electrical Manufacturing Co., Ltd.—Private company. Registered May 21st. Capital, £2,000. Objects: To acquire the business of a manufacturer of electrical apparatus carried on by H. J. Dean-Osgood at Tower Electrical Works, Old Town, Clapham. The subscribers are: H. J. Dean-Osgood, 25, Kathleen Avenue, Wembley, and Mrs. A. F. Dean-Osgood, 25, Kathleen Avenue, Wembley, Middlesex. H. J. Dean-Osgood is chairman and permanent managing director. Secretary: Miss G. L. Underhill. Registered office: Tower Electrical Works, Old Town, Clapham, S.W.

C. J. Cummins & Sons, Ltd.—Private company. Registered in Dublin May 20th. Capital, £2,000. Objects: To carry on the business of electrical engineering of all kinds, &c. The directors are: C. J. Cummins, E. Cummins, and P. Cummins, all of 19, Sandymount Avenue, Dublin.

Bakelite (I.F.S.), Ltd.—Private company. Registered in Dublin May 19th. Capital, £100. Objects: To manufacture, produce, sell and/or deal in any organic and inorganic chemical substances and products, &c. The directors are: J. E. Kingsbury and H. V. Potter, both of 68, Victoria Street, Westminster, S.W.1, and W. E. Cooper, address not stated.

Thompson Manufacturing Co., Ltd.—Private company. Registered May 21st. Capital, £10,000. Objects: To acquire the business of automobile electrical engineers and scientific instrument manufacturers carried on by the Thompson Manufacturing Co., Ltd. (now in liquidation) at Water Lane Works, Richmond, Surrey. The subscribers are: H. G. Read, The Fuchsias, 39, Riviera Drive, Southend-on-Sea; and R. M. Mylam, 54, Woodlands Park Road, South Tottenham, N.15. Solicitors: Watkins, Pulleyn & Ellison, 14, Gray's Inn Square, W.C.1.

Davies (Southend), Ltd.—Private company. Registered May 22nd. Capital, £1,000. Objects: To carry on the business of wholesale and retail suppliers of radio and electrical goods, gramophones and records, and wireless sets and musical instruments, &c. The directors are: O. Davies, R. Davies and E. Davies, all of 59, Varden Drive, Leigh-on-Sea. E. Davies is managing director for life. Registered office: 129, High Street, Southend-on-Sea.

Receiverent, Ltd.—Private company. Registered May 23rd. Capital, £10,000. Objects: To adopt an agreement with W. L. Hill, and to carry on the business of manufacturers of and dealers in and hirers out of wireless and television sets, gramophones, &c. The directors are: W. L. Hill, 43, Preston Road, Wembley Park, Mdx.; and H. A. E. Lucas, 33, Keats Grove, Hampstead, N.W. Registered office: Factory 3, Cobbold Road Estate, Willesden, N.W.10.

Pickering & Ward, Ltd.—Private company. Registered May 23rd. Capital, £250. Objects: To carry on business as electrical engineers and general electrical installation contractors, &c. The directors are: H. C. Ward, 23, Holland Road, Hamstead, Birmingham, and three others. Solicitors: E. Ernest Sargent & Son, 56/7, Queen Street, Wolverhampton.

Walter Johns, Ltd.—Private company. Registered May 23rd. Capital, £11,000. Objects: To acquire from E. A. Haas patents and applications in the United Kingdom or elsewhere for electric lampholders and other electrical fittings. The directors are: W. F. Thwaits, 17, Langley Park, N.W.7; and J. W. Wilson, 3, Limesdale Gardens, Edgware. E. A. Haas has the power to appoint himself or any other person to be a diceor. Secretary: W. F. Thwaits. Registered office: Africa House, Kingsway, W.C.2.

Electrocraft, Ltd.—Private company. Registered May 20th. Capital, £3,250. Objects: To carry on the business of manufacturers of and dealers in electrical, technical and mechanical accessories, &c. The subscribers are: W. Rosenberg, 22, Neeld Crescent, Wembley, Mdx; and E. McLeod, 24, Lady Margaret Road, N.W.5. W. Rosenberg shall be permanent managing director so long as he holds £999 shares. Secretary: Miss E. McLeod.

Returns of Electrical Companies

Suflex, Ltd.—The nominal capital has been increased by the addition of £2,000 in £1 ordinary shares beyond the registered capital of £1,000.

Britannia Wire Works Co., Ltd.—The nominal capital has been increased by the addition of £5,000 in £1 ordinary shares beyond the registered capital of £7,000.

Leda Electric, Ltd.—The nominal capital has been increased by the addition of £5,000 in £1 shares beyond the registered capital of £5,000.

Turnpress, Ltd.—The nominal capital has been increased by the addition of £6,000 in £1 shares beyond the registered capital of £10,000.

F. & D. Robinson (Warlingham), Ltd.—Debenture dated May 11th, 1936, to secure £352, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. E. Hammond, 50, Baker Street, W.

Durion, Ltd.—Issue on April 28th, 1936, of £500 debentures, part of a series already registered.

English Electric Co., Ltd.—Particulars have been filed of £1,250,000 debenture stock authorised March 26th, 1936, and covered by trust deed dated May 7th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, but excluding the benefit of a contract made in 1933 for the electrification of part of the Polish State Railways and the benefit of the guarantee given by the Board of Trade in relation thereto. The whole amount is now issued. Trustees: Whitehall Trust, Ltd.

Boroughbridge Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated September 21st, 1935 (filed March 16th, 1936). 100 shares taken up. £100 paid. Mortgages and charges, nil.

Bayton Electrical Co., Ltd.—Capital, £600 in £1 shares. Return dated July 30th, 1935 (filed April 20th, 1936). All shares taken up. £600 paid. Mortgages and charges, nil.

Higgins & Cattle, Ltd.—Capital, £5,000 in £1 shares. Return dated December 5th, 1935. All shares taken up. £5,000 paid. Mortgages and charges, £3,000.

G. A. Darby & Sons, Ltd.—Capital, £1,000 in £1 shares. Return dated August 15th, 1935 (filed February 3rd, 1936). All shares taken up. £1,000 paid. Mortgages and charges, nil.

Rational Electrical and Neon Co., Ltd.—G. C. Moody, of 10, Coleman Street, E.C., was appointed receiver on May 14th, 1936, under powers contained in debenture dated November 5th, 1935.

Switchgear Testing Co., Ltd.—Capital, £30,000 in £1 shares. Return dated April 9th, 1936. All shares taken up. £30,000 paid. Mortgages and charges, nil.

Wolsey Television, Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1935 (filed March 10th, 1936). 29 shares taken up. £29 paid. Mortgages and charges, nil.

City Notes

The Telephone Manufacturing Co., Ltd.—Presiding at the annual meeting held on Monday last, Mr. F. T. Jackson (chairman and managing director) said that during four months of the year under review the factory was not working at full capacity due to the fact that the rationalisation referred to at the last meeting had not taken full effect. The Post Office was their principal customer and it was important for the future development of telephony in this country that this body should be able to purchase at the lowest possible price. Low prices, however, could not come into effect unless planning could be carried out well ahead. During the first three months of the year the machine shop and assembly section were running at full capacity but no new work was ready for the machine shop when it should have been forthcoming to make for economic production. As a result, by the time new contracts were secured the assembly department was short of work, necessitating the dismissal of skilled operatives. However, the position was now fully realised and such a circumstance was not likely to arise in 1936. Contracts received during the past year from the subsidiaries of the associated company, Telephone Rentals, Ltd., showed an increase. A large number of patents had been taken out for apparatus closely associated with the telephone industry, but the cost of these, together with the cost of all development work, had been charged in the profit and loss account before striking the balance. So far they had not gone into the manufacture of automatic exchange equipment as they had a "gentleman's agreement" with other manufacturers not to do so for the time being. This understanding was forcing them to develop in other directions. The subsidiary companies, P. H. British Electrical Works, Ltd., and T. M. C. Harwell (Sales), Ltd., must, for the time being, be regarded as an insurance for the future in spreading the sale of the company's products. With regard to prospects, the value of orders for the first three months of the current year showed an increase of 170 per cent. over those received during the corresponding period of 1935.

The Cawnpore Electric Supply Co., Ltd.—Presiding at the annual meeting held on May 25th Mr. K. A. Scott-Moncrieff (chairman) said that the policy they had adopted of extending to consumers the benefit of the economies secured by the use of efficient plant had resulted in a considerable increase in the number of consumers and in the use they made of the supply. As a result, they found it necessary to provide further plant and mains. The new plant, which was in course of manufacture and erection, comprised boilers working at a pressure of 460 lb. per sq. in., together with turbines. The increase in demand also necessitated heavy expenditure on mains and switchgear. The total cost of these extensions would amount to more than £200,000.

Siemens Bros. & Co., Ltd., held their annual meeting on May 22nd, Lord Queenborough (chairman) presiding. In presenting the report and accounts (ELEC. REV., May 22nd, p. 764) the chairman referred to the contract awarded to them by the Australian Administration for a submarine cable connecting the mainland with Tasmania. This cable, made at the Woolwich works, was laid by the cableship "Faraday" in November last, and was put into operation in March. It provided for the simultaneous transmission by carrier current of a number of telephone conversations, telegrams, and a broadcast service over a single conductor. The British Post Office and the Dutch Administration had recently placed a contract for two such cables to connect England and Holland. They had amalgamated their manufacturing interests in submarine cable having insulation of a plastic material such as gutta percha, with the Telegraph Construction & Maintenance Co., Ltd., and Submarine Cables, Ltd., was formed in October last with a capital of £220,000, of which they held one-half of the shares. The order from the Post Office for the two Anglo-Dutch cables referred to would be executed by the new company.

The growing consumption of electricity was reflected in the increased volume of business in underground power and lighting cables, and their plant was kept far more economically employed. Exports of such cables showed a marked improvement, but increasing severity of competition still kept prices at a low level. Sales of feeder pillars, joint boxes, and other accessories had expanded, and there had been an increased output of rubber-insulated cable for home and abroad. Their plant had been kept well occupied on contracts for trunk mains and a record number of loading coils was supplied. The telephone shops were engaged to their full capacity in the manufacture of telephone equipment, orders for over forty exchanges, inclusive of extension of exchanges in provincial areas, being received. Public automatic exchange equipments for Tideway (Deptford) and Winchmore Hill were in course of manufacture, both of 10,000 lines ultimate capacity. Overseas orders included new automatic exchange equipments for Wynberg, Simonstown and Hout Bay (South Africa), and Brunswick (Australia) Melbourne area, and they had extended existing exchanges at Valetta, Bulawayo and Trindade (Lisbon). New exchanges in Capetown and Guernsey had been brought into operation. Substantial orders for telephone apparatus had been received for home and overseas, and large numbers of "Neophones" had again been ordered. They had in manufacture sixty rural exchanges, and the progress reported last year in the sales of private telephones and rental business had been maintained. Orders had been received for a number of new electric totalisator equipments, while the "Autoflex" vehicle-actuated traffic-control system, largely manufactured at Woolwich for the Siemens & General Electric Railway Signal Co., Ltd., had made great strides, particularly in the field of inter-linked systems as installed in St. Marylebone, St. Pancras, Holborn, and Kensington. An important development in this system was the traffic integrator, orders for which were being received for installation in other parts of the country. Progress had been made in the number of ships fitted with their wireless apparatus, ships' telegraph and telephone apparatus, &c. The battery business with Government Departments, municipalities and railways had been well maintained, and the price level for wireless, pocket and torch batteries had shown some signs of improvement. During 1935 the value of orders for Woolwich material for export had further improved. By far the greater part of their overseas trade was with Empire countries. Competition remained keen, and left only a small margin of profit. Their subsidiary, Siemens Electric Lamps & Supplies, Ltd., continued to make satisfactory progress. "Sieray" electric-discharge lamps had been further developed, and large numbers of "Sieray Dual" lamps had been sold for factory, street and other lighting. The lamp works at Preston were being enlarged to meet the increased demand for Siemens lamps for general lighting purposes. The agreement with the Automatic Electric Co., Ltd., for the supply of domestic electrical appliances had been terminated, and a complete range of such appliances, including electric cookers, water-storage tanks, and other heaters was to be marketed by the company under its own trade name of "Siemens." Since the beginning of the present year there had been a flow of orders substantially in excess of volume for the corresponding period of the year under review, covering practically the whole field of their activities both for home and abroad.

Whitehall Electric Investments, Ltd., reports a net income for the year ended March 31st last of £191,767, as compared with £214,472 in the preceding year. To this is added £268,492 brought in, making £460,259 available. The preference dividend absorbs £187,500 and the balance of £272,759 is carried forward. The report states that the reduction in the net income is due to the inability of the Athens companies to make remittances, consequent upon the refusal of the Greek Government since January, 1935, to provide sterling required for transfer of interest and dividends. The West of England companies made further progress in the unification of development of the undertakings in Devon and Somerset. The sales of electricity in 1935 amounted to 15,500,000 kWh, and at the end of the year the number of consumers was nearly 30,000.

Marconi's Wireless Telegraph Co., Ltd., held its annual meeting on May 21st, when Lord Inverforth (chairman) referred to the policy of accepting contracts from foreign governments on terms of deferred payments spread over a number of years, and said that they had adopted this arrangement in order to maintain their position in the overseas market against foreign competitors who had introduced this method of trading eight years ago. They were confident that the financial resources of their group would enable them to maintain their position, and although there were some inevitable risks in export trade under present conditions, they did not exceed reasonable commercial limits. The works at Chelmsford were being extended at a total cost of over £50,000. Their wireless equipment for aircraft was carried by the air liners of thirty-one British and foreign air navigation companies. With regard to television, parts of the transmitters for the Alexandra Palace installation had been constructed at Chelmsford, and they had taken out 142 patents which were applicable to the manufacture of television receivers. Overseas activities were also progressive. They had commenced to manufacture valves in Poland and Czecho-Slovakia under contracts concluded with the respective Governments, while wireless stations had been erected and plant installed in Europe, South America, Asia and Africa. They were under contract to conduct the Egyptian State broadcasting service for a long term of years, and in the summer of 1935 they entered into a similar agreement with the Government of Peru, where they also administered the Post Office. They owned the majority of the shares in the Belgrade Broadcasting Company, Jugoslavia.

Cable & Wireless (Holding), Ltd.—Presiding at the annual meeting held on May 22nd Mr. J. C. Denison-Pender (governor) referred to the question of competition and their relations with the Government. New wireless routes continued to spring up in all parts of the world, thereby exposing the company to ever-increasing competition. Since January, 1928, over 150 new wireless services had been established, mostly by foreign countries, and in many instances they were deliberately opened by the Governments concerned at uneconomic rates with the object of fostering their foreign trade. The gravity of the position was being aggravated by proposals which were continually being pressed for the inauguration of direct wireless services between foreign countries and Empire points, where telegraphic facilities by cable already existed. If these direct wireless services were permitted to be established within the Empire it would mean that the system of communication operated by their company would become uneconomic. An Imperial Conference would probably be held in London next year, and they had submitted a request that the subject of "communications" should be included in the agenda. With regard to the general question of capital reorganisation they felt that the time was not yet ripe to formulate a scheme.

Edmundsons Electricity Corporation, Ltd., reports a net profit for the year ended March 31st last of £510,253, as compared with £458,682 in the preceding year, to which is added £44,577 brought in, making £554,830 available. After writing off the stamp duty and one-half the discount in respect of the 3½ per cent. debenture stock issue, placing £50,000 to reserve, and paying the final dividend on the 7 per cent. cumulative preference shares, and accrued dividend on the 6 per cent. cumulative preference shares to March 31st, a final dividend of 4½ per cent. is paid on the ordinary shares, making 8 per cent. for the year (same). The balance carried forward is £49,719. During the year £2,000,000 of 3½ per cent. debenture stock, ranking *pari passu* with the 4 per cent. debenture stock, has been issued. The report contains particulars of the Corporation's investments in subsidiary companies. Meeting: June 2nd.

Richard Johnson & Nephew, Ltd., held their annual meeting on May 21st, when Lt.-Gen. Sir Walter Campbell, who presided, said that the year under review had been one of activity in the home market. Owing to a considerable importation of certain classes of finished wire and wire products into this country at prices far below actual costs of production they had only benefited to a limited extent by the agreement arrived at between the British Iron & Steel Federation and the International Steel Cartel limiting the import of foreign wire into this country. The non-ferrous trade has been spasmodic and had also been subject to increasingly severe competition, but they had obtained their share of what little business had been available in aluminium overhead cables.

The Dubilier Condenser Co. (1925), Ltd., reports a profit for the year ended March 31st last of £34,915, as against £28,437 for 1934-35. After providing for depreciation, &c., there is a net profit of £26,573 (against £20,095), plus £7,849 brought in. Reserve receives £6,000 and income tax reserve £4,500. The ordinary dividend is 20 per cent. (against 15 per cent.), and £8,412 is carried forward.

Vactric, Ltd., has declared an interim dividend of 6¼ per cent. (against 5 per cent.). The directors announce that the company is collaborating with an American corporation for the formation of a company in this country to market the products of the American corporation, which include electric refrigerators, washing machines and other domestic appliances.

The Barcelona Traction, Light & Power Co. reports an income for 1935 of $5,354,409 as compared with $5,070,560 for 1934, and a net revenue of $3,027,973 (against $2,797,695). Reserve receives $1,000,000, and a dividend of 50 cents was paid during the year (same).

Aron Electricity Meter, Ltd., has announced a final ordinary dividend of 10 per cent., making 15 per cent. for the year (same).

Crompton Parkinson, Ltd., have declared an interim dividend at the rate of 6 per cent. actual on the ordinary and "A" ordinary shares.

Stocks and Shares

TUESDAY EVENING.

THE outstanding item of interest in the market for electricity issues is a heavy fall in the trio of Cable and Wireless stocks. This followed immediately upon the remarks made by the chairman at the recent meeting of the combine. Expectation had fastened upon the hope that something would be done to deal with the dividend arrears of 9½ per cent. that have accumulated on the preference stock. Evidently, however, the board thought otherwise, for hardly anything was mentioned in connection with these arrears. Hence sharp declines in the prices of the stocks.

The statement of the Chancellor of the Exchequer in which he hinted at the improbability of any early reduction in taxation, made for depression in the gilt-edged market, where prices had been already inclined to ease off by reason of the overdose of new issues that has recently been poured out. Some of the later borrowers are taking a slightly lower price for their loans than they expected to do. Offers of stocks are being made at 98½, but this has not tempted the investor to any extent. In consequence, underwriters have been receiving more stock than they desired. Premiums on present-day issues of new stocks are less common than discounts.

Telegraphs and Telephones

As noted above, Cable and Wireless stocks were sold heavily after the annual meeting. The tenor of the chairman's speech left the market with the impression that there is little to "go for" in the stocks for some way ahead. Chief cause of disappointment is, of course, the decision to defer the question of further capital reorganisation until such times as a clearer view of the combine's altered earning capacity can be obtained. Apart from the weight of preference dividend-arrears left out-

standing, the chairman mentioned other factors which are scarcely calculated to cheer stockholders. All the restrictions and complications which hinder the progress of concerns having international ramifications, are mustered at full strength in the path of Cable and Wireless. Furthermore, it is clear that the very substantial economies, already effected, cannot be carried much further without impairing efficiency. On top of all this has to be considered the poor April traffics index figure. It is not difficult, therefore, to account for price-falls of 8 points in the preference stock to 103½; of 5 to 23 and 1½ to 6½ in the "A" and "B" stocks respectively. News of the increase of 1 per cent. in the dividend on Globe Telegraph ordinary shares failed to stay the price from sagging in sympathy with Cable and Wireless stocks.

Anglo-American communication stock prices turned uncertain on the resumption of hesitancy in trans-Atlantic markets. The tentative revival which began a fortnight ago has not got into its stride. American Telephone and Telegraphs reacted 2 points but regained the full amount. Internationals, at 14, are also unchanged after being lower. Western Unions recovered to 80 after falling to 78. Canadian Marconis are a shade under 8s. Anglo-Portuguese Telephones improved to 30s.

Manufacturing and Equipment Shares

Crompton Parkinson shares are very steady, at the price of 65s., on the announcement of the 6 per cent. interim dividend. The latter is at the same rate as last year's, but is being paid on a capital which was more than doubled by last November's capital bonuses. The present distribution can leave little doubt as to the flourishing condition of the company's trade. Publication of the Chloride Electrical Storage Company's full accounts, which emphasise the cautious dividend policy and the strength of reserves, did nothing to help the price of the shares. The quotation eased further to 4½.

With one eye on the restless foreign scene and the other on the promising aspect at home, the market for electrical equipment shares marks time fairly steadily. While it is true that the few price-changes which do occur are usually in a downward direction, the fact that prices are maintained as well as they are, at a time when buying-power has been noticeably diminished, speaks well for the fundamental strength of the market. Callenders, Henleys and Enfield Cables are among the shares which have lost ground, the fall in each case amounting to half-a-crown. Enfield Rolling Mills are 1/6 lower at 21s. 9d. Hall Telephones shed 6d. to 20s. 9d., and International Automatic "B" 1s. 3d. to 44s. 9d. English Electric ordinary moved up 6d. to 22s., but the preference eased off to 25s. 3d.

G.E.C. Strength

General Electrics are a good spot at 80s. 6d., showing an eighteenpenny rise on the imminent approach of the dividend announcement. Last year's distribution was 10 per cent., against 8 per cent. for 1933. Optimism canvasses estimates of increased dividend and, also, the possibility of a bonus in some shape or another. Reyrolles rose 3s. to 74s. Ismay Industries at 7s. 6d. have shed a few pence. An interesting review by the chairman at the meeting of the Telephone Manufacturing Company caused the shares to harden to 10s. Telephone Rentals are 9s. 9d.

Electricity Supply Shares

Whitehall Electric Preference fell 2s. to 23s. 6d. on publication of the company's report. Currency restrictions appear to be mainly responsible for the shrinkage of income which took place in spite of reduction in the annual debenture charge. With no improvement in the disturbed state of affairs in Palestine, Jerusalem Electric and Palestine Electric "A" shares weakened afresh. The price of the former fell ½ to 35s., and of the latter 1s. 6d. to 45s. 6d. Calcutta Electrics, after a lengthy decline, have come to rest round 55s. East Africans and Kalgoorlies shed a few pence to 31s. 6d. and 14s. 6d. respectively.

The Home electricity supply group is in a neglected and uninteresting condition. Electric Supply Corporations fell 1s. to 62s. County of Londons and one or two others lost small fractions. The rise in West Gloucestershires was continued from 124 to 128. London Associated Electrics are rather better at 35s. Edmundsons are no more than steady on the record figures in the accounts.

Miscellaneous Matters

Brazilian Tractions failed to hold the rise occasioned by the unexpected dividend decision. Hydro Electrics stand firm, but International Holdings have given way to 1½.

Steady buying of Consolidated Signals raised the price by 3/16 to 5 1/16. Westinghouse Brakes remain at 3. Babcock & Wilcox continue dull despite signs of renewed interest in iron, steel and allied shares as a whole. International Combustions declined from 98s. to 96s., and Pressed Steels from 23s. 9d. to 23s. Vactrics are good at 27s. 3d.; the interim dividend is raised from 5 per cent. to 6½ per cent., and the company is making arrangements to extend its activities over a wider range of electrical appliances. The generally unfavourable market conditions are mainly responsible for losses ranging up to 1/8 in the prices of such shares as Pye Radio deferred, 12s. 3d. ex-dividend, Tube Investments, 65s. 3d., Associated Equipments, 45s., and S. Smith preferred, 74s.

Electric and Musical Industries at 25s., E. K. Coles at 27s. 6d., and Electrolux at 10½, are lower on the week.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. Previous.	Dividend. Last.	Price May 26.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	77/6	—	3 17 5
City of London	1	7½	7½	37/–	–6d.	4 1 1
Clyde Valley	1	7	8	45/–	—	3 11 1
County of London	1	10½	10½	56/–	–6d.	3 15 0
Edmundson's 7% Pref.	1	7	7	36/–	—	3 17 9
Do. Ord.	1	8	8	43/6xd.	—	3 13 7
Elec. Dis. Yorkshire	1	9	9	47/6	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	62/–	–1/–	3 11 0
Lancs Light and Power	1	7½	7½	39/–	—	3 17 0
Lond. Assoc. Electric	1	—	7	35/–	+6d.	4 0 0
London Electric	1	7	8	40/–	—	4 0 0
London Power Deb. Red.	Stock	5	5	108½	—	4 12 2
Metropolitan	1	10	10	51/6	—	3 17 7
Midland Counties	1	7	7½	41/–	—	3 13 2
Mid. Elec. Power	1	8	8	42/–	—	3 16 2
North Eastern Electric Ordinary	1	6	6	35/–	—	3 8 7
Do. 7% Pref.	1	7	7	35/–	—	4 0 0
Northampton	1	10	10	53/9	—	3 14 5
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	58/9	—	3 8 0
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	43/–	–6d.	3 14 5
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6	–2/–	6 7 8
Yorkshire Elec.	1	8	8	46/–	—	3 9 7

Public Boards.

Central Electricity, 1950–70	Stock	5	5	118	—	4 4 9
Do. 1955–75	„	5	5	120	—	4 3 4
Do. 1951–73	„	4½	4½	112	—	4 0 4
Do. 1963–93	„	—	3½	102	—	3 8 8
London Elec. Trans. Gtd.	„	—	2½	97	—	2 11 7
London & Home Counties, 1955–75	„	4½	4½	113	—	3 19 8
London Passenger Transport, A	„	—	4½	125½	—	3 11 9
Do. do. B	„	—	5	129	—	3 17 6
Do. do. C	„	3½	4	103	—	3 17 8
West Midlands Joint Elec. 1948–68	„	—	5	116½	—	4 5 10

Telegraph and Telephone.

American Tel. & Tel.	$100	9	9	162½	—	5 10 9
Anglo-Am. Tel. Pref.	Stock	6	6	125½	—	4 15 7
Do. Def.	„	1½	1½	30	—	5 0 0
Cable & Wireless 5½% Pref.	„	4½	5½	103½	–8	5 6 3
Do. A. 7½% Ord.	„	Nil	Nil	23	–5	—
Do. B. Ord.	„	Nil	Nil	6½	–1½	—
Globe Tel. & Tel. Ord.	10	3½*	4½*	16	–½	2 16 3
Do. do. Pref.	10	6	6	14½	—	4 4 3
Great Northern Tel.	10	20	20	44	—	4 11 0
Marconi-Marine	1	10	7½	32/6	—	4 12 4
Oriental Telephone Ord.	1	12*	12*	3½	—	3 16 10

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	1550xd.	—	—
Do. do. Pref. Ord.	„	8	8	179½xd.	—	4 8 2
Brazil Traction	100	—	30 cts.	12½	–½	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	102½	—	4 17 7
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	77/6	—	—
West Riding	1	5	6½	52/6	—	2 9 6

Manufacturing Companies.

Aron Electricity Ord.	1	10	15	63/9	—	4 14 4
Assoc. Elec. Ord.	1	6	8	46/–	—	3 9 7
Do. Pref.	1	8	8	39/–	—	4 2 1
Babcock & Wilcox	1	8	8	47/6	–6d.	3 7 5
British Aluminium Ord.	1	7½	7½	40/–	—	3 15 0
British Insulated Ord.	1	15	20	5½	—	3 14 5
Brush Ord.	Stock	Nil	Nil	42½	—	—
Callender's	1	15	15	4½	–½	3 10 7
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	—	12½	65/–	—	1 0 0
Do. 8% Pref.	1	8	8	2	—	4 0 0
Edison Swan 1st Pref.	1	7½	7½	30/–	—	5 0 0
Electric Construction	1	Nil	3½	1½	—	2 0 0
Enfield Cable Ord.	1	25	25	5½	–½	4 15 5
English Electric	1	Nil	Nil	22/–	+6d.	—
Do. do. Pref.	1	Nil	Nil	25/3	–3d.	—
Ericsson Tel.	5/–	24	20*	2½	—	2 4 6
Ever Ready	5/–	35	35	25/6	—	6 17 3
Ferranti Pref.	1	7	7	27/–	—	5 3 8
G.E.C. Pref.	1	6½	6½	32/-xd.	—	4 1 3
Do. Ord.	1	8	10	80/6	+1/6	2 9 8
Henleys	1	30	30	7 1/8	–½	4 3 6
Do. 4½% Pref.	5	4½	4½	5½	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	46/3	—	4 6 6
Lancashire Dynamo	1	5	10	2½	—	4 9 0
Siemens Ord.	1	4	6	26/3xd.	—	4 11 5
Telegraph Construction	£1	Nil	Nil	26/3	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

21934. "Machines for winding coils for electrical devices." A. H. Stevens (General Motors Corporation). July 26th, 1934. (446415.)

24629. "Television arrangement, more particularly for projection and kinematograph purposes." Radio Akt.-Ges. D. S. Loewe. August 31st, 1933. (446263.)

26783. "Supply arrangements for luminous electric-discharge tubes." G. T. Kingsley-Lark. March 18th, 1935. (446264.)

27485. "Thermionic-valve circuit arrangements for generating oscillations." Plessey Co., Ltd., and A. D'A. Hodgson. September 25th, 1934. (446497.)

27846. "Electric cooking or like devices." General Electric Co., Ltd., and G. S. Cattell. September 28th, 1934. (446499.)

27988. "Braun tube, more particularly for television purposes." Radio Akt.-Ges. D. S. Loewe. October 2nd, 1933. (446635.)

30519. "Electrical overhead-cable systems." Bayernwerk Akt.-Ges. October 24th, 1933. (Cognate application, 30520/34.) (446504.)

30755. "Electric starting systems for internal combustion engines." Eclipse Machine Co. October 27th, 1933. (446512.)

30756. "Electric starting systems for internal combustion engines." Eclipse Machine Co. October 27th, 1933. (446283.)

30790. "Apparatus for radio communication." C. E. Randall. October 26th, 1934. (446514.)

30826. "Traffic-control signals." Automatic Electric Co., Ltd., A. P. B. Renshaw and P. B. Botcherby. October 26th, 1934. (446288.)

30834. "Galvanometers, oscillographs and the like." H. W. Aldrich and W. Gannon. October 27th, 1934. (446575.)

30853. "High-frequency transformer circuits, more particularly for television purposes." Radio Akt.-Ges. D. S. Loewe. October 27th, 1933. (446346.)

30879. "Electric cable systems." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. October 27th, 1934. (Cognate application 12436/35.) (446347.)

31134. "Electric ceiling, floor and wall lamps." C. Harvey and W. Maitland. October 30th, 1934. (446293.)

31272. "Electrical energy supply and regulator systems." Marconi's Wireless Telegraph Co., Ltd. October 31st, 1933. (446294.)

31553. "Separation of synchronising signals in television receivers." P. W. Willans and Baird Television, Ltd. November 2nd, 1934. (446432.)

31868. "Electrical time-measuring arrangements." Siemens Bros. & Co., Ltd., and H. E. Humphries. November 6th, 1934. (446433.)

31876. "Incandescent electric lamps." Z. Dezsoe. November 6th, 1934. (446297.)

31908. "Method of and apparatus for television and like transmission." D. M. Johnstone and Baird Television, Ltd. November 6th, 1934. (446585.)

32698. "Electrical control or protection apparatus." Kingsway Radio, Ltd., and G. L. D'Ombrain. November 13th, 1934. (Cognate application 33757/34.) (446299.)

32858. "Devices for inserting granular insulating masses in electric tubular heaters." Siemens-Schuckertwerke Akt.-Ges. November 15th, 1933. (Cognate applications 32859/34 and 32861/34.) (446588.)

33160. "Mounting of electric insulators." L. Thiry. December 2nd, 1933. (446440.)

1935

57. "Electrical musical instruments." J. Compton Organ Co., Ltd., and L. E. A. Bourn. January 1st, 1935. (446352.)

611. "Methods of synchronising in television." J. C. Wilson and Baird Television, Ltd. January 8th, 1935. (446354.)

2370. "Electric-current rectifiers or invertors." British Thomson-Houston Co., Ltd. January 25th, 1934. (446541.)

2604. "Carriers for cartridge fuses as used, for example, in electric cut-outs and disconnecting boxes." W. T. Henley's Telegraph Works Co., Ltd., and H. W. Breeze. January 26th, 1935. (446596.)

3564. "Vehicle headlights and like electric lamps." T. B. S. Brereton. February 4th, 1935. (446545.)

4317. "Relaxation oscillation generators for use with cathode-ray tubes." Radio Akt.-Ges. D. S. Loewe. February 12th, 1934. (Cognate application 4318/35.) (446547.)

4670. "Band- or ring-shaped magnetic cores." Siemens & Halske Akt.-Ges. February 28th, 1934. (446602.)

5122. "Electromagnetically operated timing mechanism for electric switches." E. J. Rocher. February 16th, 1935. (446604.)

5496. "Electron tubes or valves." Dr. K. Freytag. February 20th, 1935. (Convention date not granted.) (446452.)

5635. "Electric insulators for use on very high radio frequencies." Marconi's Wireless Telegraph Co., Ltd., and H. A. Ewen. February 21st, 1935. (446549.)

5971. "Electric hotplates." General Electric Co., Ltd., and J. L. Rycroft. February 25th, 1935. (446550.)

6136. "Electric hotplates." General Electric Co., Ltd., and J. L. Rycroft. February 26th, 1935. (446453.)

8072. "Electric dry cells." J. R. Cullen. March 15th, 1935. (446551.)

8423. "Automatic telephone systems." Siemens Bros. & Co., Ltd., W. G. Patterson and R. G. Dixon. March 18th, 1935. (446454.)

10985. "Regulating transformers." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. May 18th, 1934. (446455.)

10988. "High-frequency electric cables." Siemens & Halske Akt.-Ges. April 9th, 1934. (446553.)

12529. "Electron-discharge devices." Rogers Radio Tubes, Ltd. April 26th, 1934. (446606.)

14213. "Electric condensers." Plessey Co., Ltd. May 15th, 1934. (446367.)

15441. "Systems for signalling over electric distribution networks." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gas. May 28th, 1934. (Cognate application, 15442/35.) (446611.)

17309. "Electric battery lamps." S. Wiseman. June 15th, 1935. (446376.)

18449. "Machines for making mounts for electric incandescent lamps and the like." British Thomson-Houston Co., Ltd. June 30th, 1934. (446382.)

18602. "Electric batteries or accumulators, more especially for motor-cars." A. Ricks. June 28th, 1935. (446384.)

22411. "Machines for winding coils for electric devices." A. H. Stévens. (General Motors Corporation.) July 26th, 1934. (Divided out of 446415.) (446464.)

22607. "Method for the production of dark electrolytic deposits of rhodium." W. C. Heraeus Ges. June 4th, 1935. (446393.)

23370. "Electrical luminous-discharge device for the production of green light, and glass tubing for the manufacture thereof." M. Fischer, H. Fischer and M. Fischer (trading as Glaswerke G. Fischer.) August 20th, 1935. (446615.)

24227. "Circuit arrangement for the magnetic deflection of the cathode-ray of a Braun tube." C. Lorenz Akt.-Ges. September 7th, 1934. (446618.)

24292. "Electric tumbler switches." R. Schneider, K. Milferstedt, and A. Walter. September 1st, 1934. (446562.)

24581. "Production of waterproof rubber particularly suited for electric cable insulation." Siemens-Schuckertwerke Akt.-Ges. September 28th, 1934. (446399.)

24595. "Wireless directional aerial systems." Telefunken Ges. für Drahtlose Telegraphie. September 3rd, 1934. (446619.)

24918. "Dynamo-electric machines." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. September 12th, 1934. (446402.)

25257. "Self-starting synchronous motor." British Thomson-Houston Co., Ltd. September 11th, 1934. (446469.)

25436. "Extrusion presses with electrically heated receivers for the production of metallic tubes and rods." W. W. Triggs (Schloemann Akt.-Ges.). September 13th, 1935. (446322.)

29254. "Electric switches suitable for use with battery lamps." L. P. G. Ketner. October 23rd, 1935. (446476.)

30466. "Apparatus for making electric heating units." British Thomson-Houston Co., Ltd. November 3rd, 1934. (446628.)

31730. "Circuit arrangements comprising a gas-filled electric-discharge tube." Naamlooze Vennootschap Philips' Gloeilampfabrieken. December 14th, 1934. (446630.)

32182. "Cathodes for electric-discharge devices." British Thomson-Houston Co., Ltd. November 20th, 1934. (446478.)

32986. "Methods of photo-electrically measuring the light-absorbing or reflecting capacity of substances." C. Zeiss (firm of). December 15th, 1934. (Addition to 24437/35.) (446333.)

33564. "Electric hot-plates." Elektro-Gerätebau Ges. and K. Fischer. December 4th, 1935. (446410.)

34480. "Electric incandescent lamps for use in mines and like locations." General Electric Co., Ltd. December 12th, 1934. (Cognate application 34481/35.) (446480.)

34684. "Removal of disturbances in high-frequency receiving apparatus." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. December 15th, 1934. (Addition to 442626.) (446634.)

35375. "Circuit arrangements for regulating the potential of electric consumer circuits, particularly lighting circuits, by means of controlled discharge gaps." J. T. Shevlin (Siemens-Schuckertwerke Akt.-Ges.). December 20th, 1935. (446482.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 20th:—

Zenith. No. 559241. Class 8. Electrical apparatus for controlling from a distance the supply of fuel, air and mixture to internal-combustion engines.—The Zenith Carburetter Co., Ltd., 40-42, Newman Street, W.1.

Rotalix. No. 566538. Class 8. Electric discharge tubes, &c. No. 566537. Class 11. Instruments, apparatus and contrivances (not medicated) for surgical or curative purposes or in relation to the health of man or animals.—Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.

Circle and Stars (design only). No. 566712. Class 8. Instruments and apparatus for use in telegraphy, telephony, wireless telegraphy and telephony, television, for recording, reproducing and amplifying sound, electric resistances, electric lighting transformers (static), electric lamps (not curative) for scientific apparatus and discharge tubes.—Philips Lamps, Ltd.

Philite. No. 566554. All goods in Class 8. No. 566555. Class 50. Condensation products of phenol and formaldehyde sold in the form of solid masses for use in moulding articles.—Philips Lamps, Ltd.

Arlita. No. 566526. Class 11. Instruments, apparatus and contrivances (not medicated) for surgical or curative purposes or in relation to the health of man or animals. No. 566527. Class 13. Metal goods.—Philips Lamps, Ltd.

Arga. No. 566519. Electric incandescent lamps.—Philips Lamps, Ltd.

Philuma. No. 566530. Philora. No. 566552. Ultrasol. No. 566556. Class 13. Electric lamps (ordinary) and electric lighting fittings. Class 13.—Philips Lamps, Ltd.

Philiflood. No. 566540. Class 18. Electric lighting installations for floodlighting or for projection purposes.—Philips Lamps, Ltd.

Lumoscope. No. 567188. Class 11. Magnifying and illuminating devices, being surgical appliances for use in the examination of teeth.—The Detroit Dental Manufacturing Co., Detroit, U.S.A. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Carend. No. 564956. Reforend. No. 567972. Stabiend. No. 567973. Tensiend. No. 567974. Class 13. Electrodes of ordinary metal for electric welding.—La Société Le Soudure Electrique Autogène, Brussels, Belgium. (British representative: M. C. J. Gheuray Bray, First Avenue House, High Holborn, W.C.1.)

Feridax. No. 565855. Class 13. Electrical switches, &c.—James R. Ferriday, 52, Vyse Street, Birmingham.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdare.—Houses (126), Hirwaun; U.D.C. surveyor.

Althorpe (DONCASTER).—Houses (44), Station Road, for Lockwood & Egarr.

Banffshire.—Schools, Buckie, for County E.C.

Berkhamsted.—Houses (50), Highfield estate; U.D.C. surveyor.

Birmingham.—Bakery, Stechford, for the Birmingham Co-operative Society, Ltd., High Street (£80,000), with electrical work; Co-operative Building Department, Holt Street. Factory, Factory Road, Handsworth, for Cheney & Son, Ltd.; E. Crowder, builders, South Road, Birmingham. Factory, Tyburn Road, for British Cyanides, Ltd. Factory and showroom buildings, Coventry Road, for C. Churchill & Co., Albert Street (£50,000), with electrical work; Harvey & Wicks, architects, 5, Bennett's Hill. Offices, &c., Constitution Hill, for Jones, Edmunds, Ltd.; J. Peace, builders, 178, Victoria Road, Aston.

Blackburn.—Extensions to the Omnibus Garage, George Street, for the Ribble Motor Services, Ltd., Frenchwood Avenue, Preston; W. Livesey & Co., Ltd., builders, Nova Scotia Works.

Blaydon-on-Tyne.—Cinema, for Gillespie Brothers, Newcastle-on-Tyne (£20,000); Bell Brothers, builders, Back Cleveland Road, Sunderland.

Bootle (LANCASHIRE).—Hospital and sanatorium, Edge Lane, Sefton; borough surveyor.

Boston.—Houses (266); D. G. Cockrill, borough surveyor.

Bradford.—Houses (258), Canterbury Avenue; city architect, Town Hall.

Bury (LANCASHIRE).—Cinema, Bolton Street (electrical work), for Bury Cinematograph Co., Ltd.; T. Lewis, director.

Buxton.—Girls' Senior school, Silverlands (£27,000), for E.C.; F. Langley, borough surveyor, Town Hall.

Cardiff.—Houses (252), Ely estate; city engineer, City Hall.

Carlisle.—Houses (456); city engineer, 18, Fisher Street. Bus station, Lonsdale Street, for the Caledonian Bus Co., 109, Lowther Street.

Carmarthenshire.—County Buildings, Carmarthen (£100,650), with electrical work; Percy Thomas, architect, Cardiff.

Cheadle (STAFFORDSHIRE).—Houses (70); R.D.C. surveyor.

Chesham.—Houses (100), Pond Park estate; U.D.C. surveyor, Bank Chambers, Station Road.

Coventry.—Houses, Bell Green and Canley (£32,451); city engineer.

Croydon.—Houses (47), Ash Tree Way; West & Co., Ltd. Houses, Leighton Street (£86,900), and extensions to Queen's Road Homes (£50,550); borough engineer.

Dalkeith.—Houses (159); A. Forrester, burgh surveyor, Municipal Buildings.

Derby.—Houses (600), Roe Farm estate; C. H. Aslin, borough architect, Gower Street.

Doncaster.—Houses (70), near Scrooby Road, Harworth; Adam Eastwood & Son, Burns Lane, Warsop.

Dumbarton.—Houses (914) for C.C., in three years (£472,800); Joseph Wakes, 18, Park Circus, Glasgow.

Dunmow.—Houses (78); J. H. Nicholson, U.D.C. surveyor.

Edmonton.—Reconstruction of Chase Farm schools (£120,087); A. Monk, Edmonton.

Enfield.—Estate development, Baker Street; Martyn (Builders), Ltd.

Exeter.—Cinema, London Inn Square; Regal Co.

Gateshead on-Tyne.—Houses on the Celtic Football ground and Old Ford; F. H. Patterson, borough engineer.

Glasgow.—Chemistry institute for the Glasgow University (£200,000); Prof. T. Harold Hughes, Glasgow University.

Guildford.—Factory, for Dennis Bros., Ltd. (£30,000).

Hampshire.—Schools (720 places), Eastleigh; director of education, Winchester.

Haydock (LANCASHIRE).—Houses (186); R. Main, U.D.C. surveyor.

Hertfordshire.—Modern schools, St. Albans (£36.953), and Welwyn Garden City (£35.000), and two schools, Barnet (£16,960); director of education, Hertford.

High Wycombe.—Factory, Gillets Lane, for E. Van de Winckel.

Hinckley.—Enlargement to Grammar school (£21,275); Orton & Co.

Huddersfield.—Extensions to Mill Hill isolation hospital, Dalton; borough engineer.

Irvine (AYRSHIRE).—Extension to factory premises, for the Irvine Hosiery Manufacturing Co., Ltd.

Iver.—Film studios (£600,000); British & Dominions Film Corporation, Ltd.

Kent.—Mental hospital, Eynsford, electrical work (£750,000), for C.C.; clerk, Maidstone. Technical institute, Bromley; county architect.

Kesteven.—Accommodation for mental defectives, Holbeach (£24,000), for the Joint Mental Board; clerk, Sleaford.

Lanarkshire.—Houses (100), Douglas, for C.C.; housing architect, Renfield Street, Glasgow.

Lanchester (CO. DURHAM).—Central hospital (£60,000), for the Joint Hospital Board; clerk.

Lancing.—Houses (52); D. A. Hopper, builder.

Leeds.—Bus depôt, Headingley, and cleansing depôt, City engineer, Tong Lane, Wortley.

Liverpool.—Factory, Speke estate, for the Manesty Machines, Ltd. Special school, Higher Lane, Fazakerley; land steward and surveyor, Municipal Buildings.

London.—(CLAPHAM).—Tenements, Poynders Road (£75,000); L.C.C. architect. (E.C.).—Extensions to City of London school and swimming bath (£40,000); city engineer. (FINSBURY).—Health centre and offices, Northampton Road; borough engineer. (HAMPSTEAD).—Nurses' home, New End Hospital (£43,500): L.C.C. architect. (PLUMSTEAD).—Enlargement of St. Nicholas Hospital (£87,700); L.C.C. architect. (PUTNEY).—Reconstruction of bus garage, Putney Bridge, for the London Passenger Transport Board. (ST. MARYLEBONE).—News cinema, 96-8, Baker Street; Marshall & Tweedy, 9, New Cavendish Street, W.1. (SHOOTER'S HILL).—Extensions to Brook Hospital (£137,000); L.C.C. architect. (SOUTHWARK).—Houses, Law Street (£720,000); L.C.C. architect. Premises for the Royal Eye Hospital (£200,000); Governors.

Long Benton.—Houses (200); U.D.C. surveyor.

Luton.—Cinema, Gordon Street, for Southan Morris Circuit, Ltd. Houses (120), Lane Farm Estate Co.

Manchester.—Houses, Assheton Road, Assheton Crescent and Marguerita Street, Newton Heath; E. France & Son, Ltd., builders, 50, Windsor Avenue, Gatley, Cheshire. Houses (43), Ellbourne Road, Hill Crescent and Hill Crescent Road, Brackley; A. J. Jackson, builder, Ellbourne Road, Blackley. Houses (30) and shops, near Kingsway, Didsbury, for W. Campion; Storey & Stead, 31, King Street West.

Mansfield.—Cinema, Mile Hill; Bocock & Kirk, architects.

Marlow (BUCKINGHAMSHIRE).—Cinema, for the County Cinemas, Ltd.

Much Wenlock (SHROPSHIRE).—Houses (130), Madeley; borough surveyor.

Newcastle-on-Tyne.—Houses, Pottery Bank site and Blakelaw estate; R. G. Roberts, city architect, 18, Cloth Market. Cinema (2,000 seats) on the site of the old police station, Westgate Road, for the Essoldo Cinema Co.; W. Stockdale, 73, Howard Street, North Shields. Additions to factory, Dinsdale Place, for the Anglo-Scottish Trading Co., Ltd.; Alnwick Construction Co., Ltd., builders, Alnwick.

Nuneaton.—Cinema, Abbey Street; Union Cinema Co., Ltd.

Oldham.—Garage for 250 buses, with workshops, mess room, assembly hall, offices, &c.; borough engineer.

Ormskirk.—Factory (£200,000), Netherton, for Littlewood's Mail Order Stores; John Moores, managing director, Freshfield, Formby, Liverpool.

Partick (NEAR GLASGOW).—Creamery, for Ross's Dairies, Ltd., Glasgow.

Peeblesshire.—Reconstruction of and extension of County High school (£26,000), for County E.C.

Peterborough.—Houses (50), Park Lane estate, near Padholme Road; town clerk.

Prudhoe-on-Tyne.—Cinema, for E. J. Hinge, cinema proprietor, Grey Street, Newcastle-on-Tyne; P. L. Browne & Son, architects, Pearl Buildings, Newcastle-on-Tyne.

Reading.—Extensions to school, electrical work (£28,799); F. V. Merriman, director of education.

Rowley Regis.—Schools (600 places), Tividale and Rowley; director of education.

Rugeley (STAFFORDSHIRE).—Houses (84); W. E. Rogers, U.D.C. surveyor.

Salford.—Cinema, Cross Lane (£50,000), (electrical work); John Buckley, Prince's Theatre, Manchester.

Seaham Harbour.—Houses, Princess Road; U.D.C. surveyor.

Southend-on-Sea.—Town hall (£300.000); E. Vincent Harris, architect, Clifford Street, London, W.1.

South Harrow.—Elementary school, Torbay Road (£23,203); Y. J. Lovell & Son.

Southport.—Police headquarters, courts, fire station, &c., electrical work (£79,778); Cooke, Thomas & Dickinson, architects, Bennett's Hill, Birmingham.

Stirling.—Extension to municipal buildings (£42,000); burgh surveyor, Municipal Buildings.

Stonehaven.—Premises, Evan Street and Cameron Street, for the Northern Co-operative Society, Aberdeen; Tawse & Allan, architects, 10, Bon Accord Square, Aberdeen.

Sturminster Newton (Dorset).—Public offices: A. J. Allen, architect, Half Moon Street, Sherborne.

Swansea.—Garage for 200 buses, with club room, canteen, &c., electrical work, for the South Wales Transport Co., Ltd.; H. A. Ellis & Son, architects, St. Mary Street. Alterations to two schools (£41,000), for E.C.

Swindon (WILTSHIRE).—Municipal offices; Bertram, Bertram & Rice, architects, 36, St. Giles, Oxford.

Urmston.—Houses (99), near Carrington Bridge; Bainbridge Bros., builders, Carrington Road. Houses, Davyhulme, Kingsway, for aged persons; E. L. Leeming, surveyor.

Uxbridge.—Reconstruction of premises, corner of Vine Street and High Street; Dr. Harold Vickers.

Walsall.—Houses (150); borough surveyor.

Warlingham.—Extensions to mental hospital (£176,000); Croydon Corporation.

Windsor.—Houses (50); borough surveyor.

Wombwell (YORKSHIRE).—Houses (56), Summer Lane, for A. Dobson. Houses (39); W. Quest, U.D.C. surveyor.

Worcestershire.—Technical school, Halesowen (£40,000), for County E.C.

Worsborough (Yorkshire).—Houses (150), near Yews Lane site; T. Shield, U.D.C. surveyor.

Wrexham.—Cinema, High Street, Pentre Broughton, electrical work, for David Davies.

Yeovil.—Factory, Martock, for Yeo Bros. & Paull (£100,000).